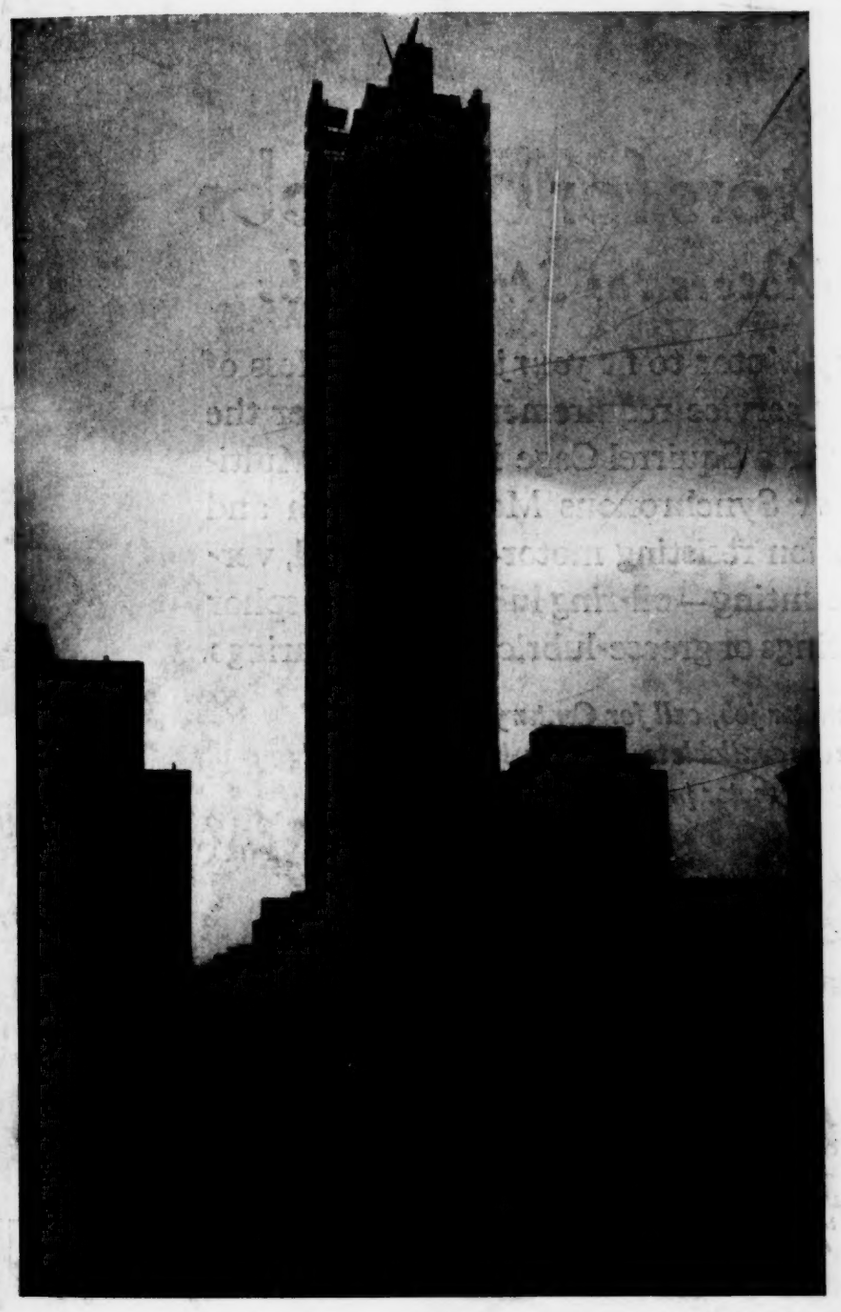
Heating and Ventilating



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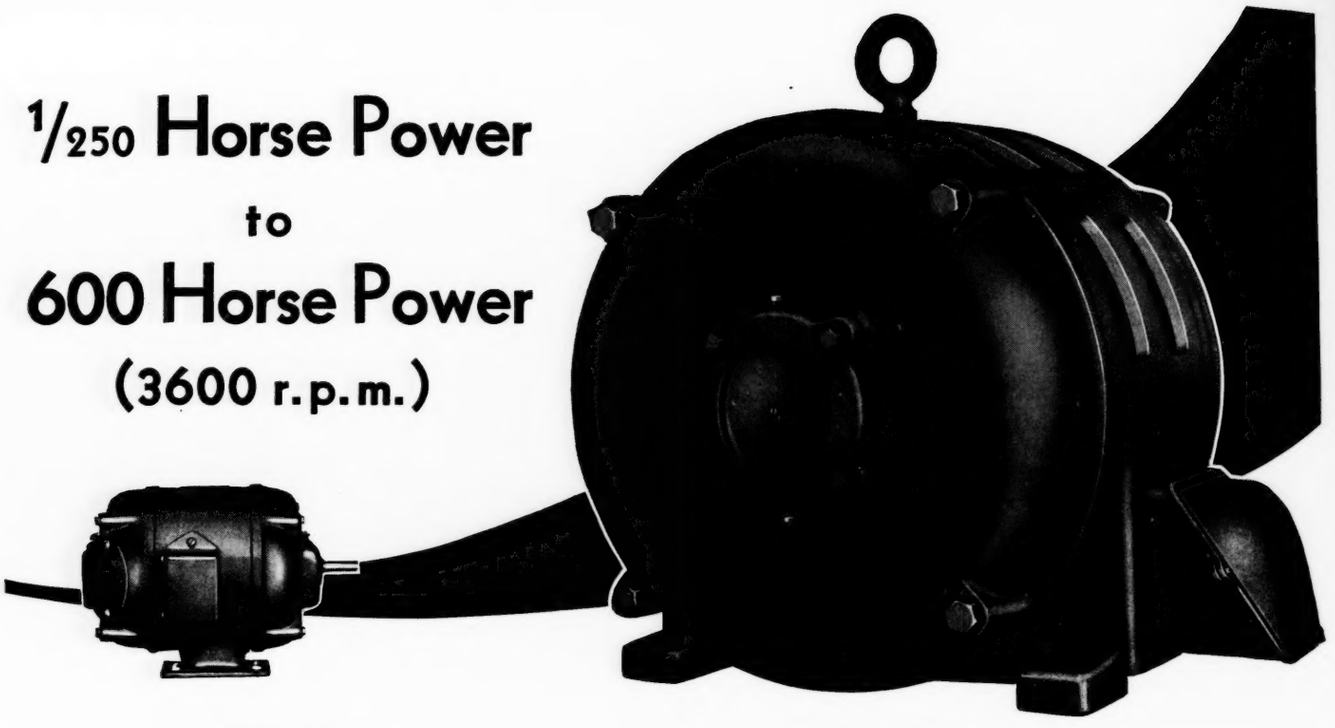

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Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

Volume 30 JANUARY, 1933 Number 1

CONTENTS

1932 Passes in Review 11
The Year's Business—Trends, Volumes and Sales 14
Research Work of the Year 20
The Trade Associations in 1932 23
The Year's New Equipment 27
The First Completely Air Conditioned Theater in Spokane ..... *R. H. Beck* 31
Detroit Utility Investigates Air Conditioning Costs and Methods 33
The Effect of Retrenchment on Housing and Office Space 34
Advantages of Welded Piping in Home-Heating Systems ..... *Fred J. Maeurer* 35
Correcting Radiator Sizes for Off-Standard Conditions (Charts) 37
Heating and Air Conditioning a New England Mansion ..... *C. Eugene Center* 40
Some Applications of Pipe Welding 44
Washed Air to Preserve Book Bindings 45

DEPARTMENTS

Abstracts 46
Your Everyday Problems 49
H. & V.'s Reference Data—1 and 2 (Estimating Weights of Ducts) (Facing page 50)
News of the Month 51
New Equipment 58
Degree Days for November, 1932 68
The Weather for November, 1932 70

Published Monthly by

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ROBERT B. LUCHARS, President — EDGAR A. BECKER, Vice-Pres. and Treasurer — ERIK OBERG, Secretary
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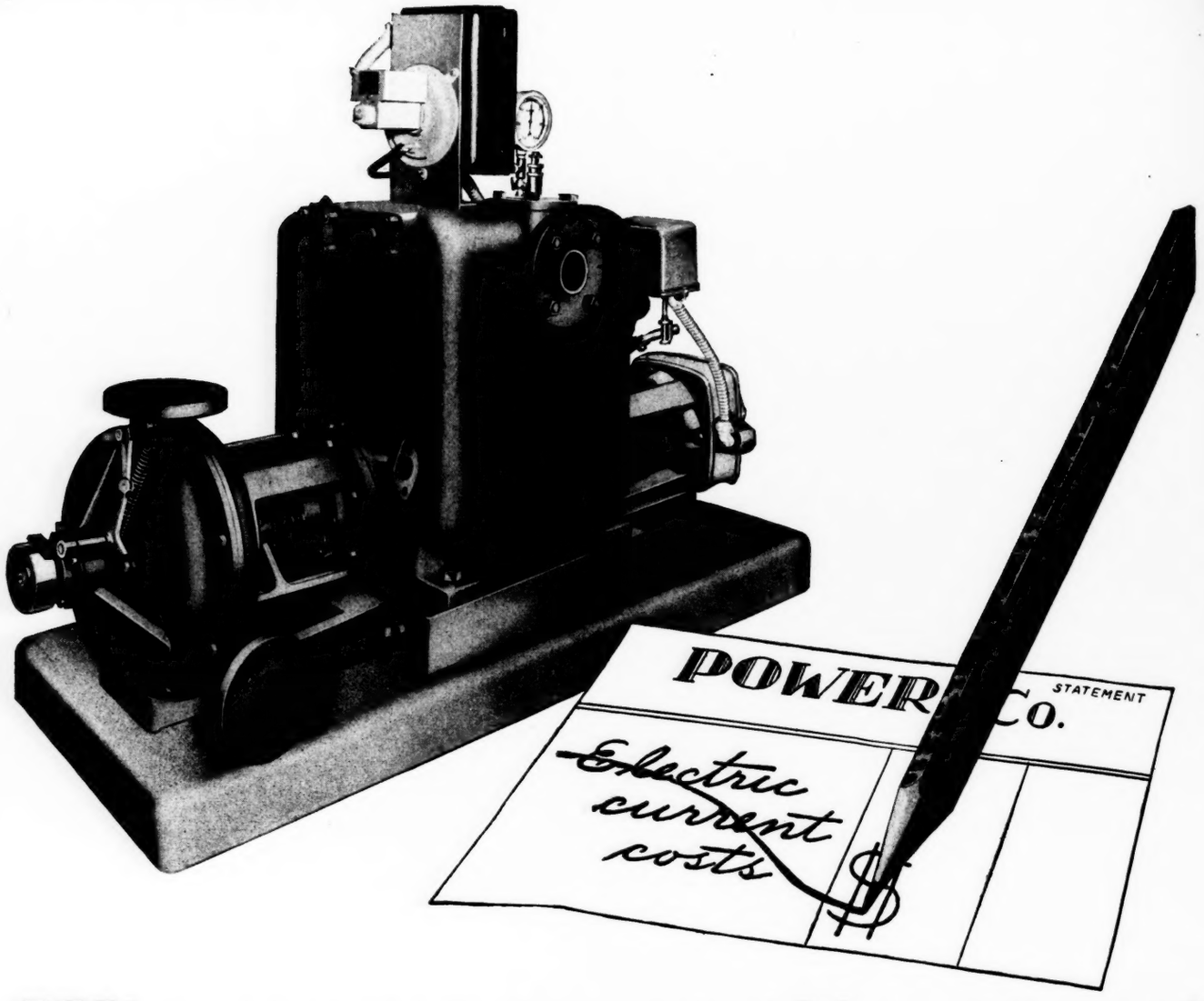
Subscription, $2 per year in United States and Mexico, $2.50 in Canada. $3 all other countries. Single copies regular issue, 30 cents; special issues, $1.



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THE NASH ENGINEERING COMPANY
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1932 Passes in Review

THE year-end is always a good time to look back and get a firm grasp of what has just taken place before looking ahead to the new year's work. Events take place in the usual order of things, and we get a chance to note them only in passing without having time or perspective to examine them and their effects comprehensively. Neither do isolated facts or occurrences reveal trends. It is with the hope that this comprehensive summary of events and interpretation of trends will serve a useful purpose in bringing things into better focus that we have prepared it and offer it at this time.

Even in this off year—and its degree of offness is one of its chief traits—so many things have taken place that the decision of what to include and what to leave out is hard to make. In preparing this review, we have tried to include those items which either are of importance in themselves or which are one of a chain of events whose effects as a whole are important.

The condition of general business during the year is so well known and is so painful a subject that we will dwell upon it no longer than necessary, and will hasten to get to the more pleasant subjects of the genuinely constructive events. We believe that you will be pleasantly astonished when we call attention to these and when you realize that, after all, this industry has much to be proud of in the record it has made in the last 12 months.

The Year's Business

Since we have to face the facts, we may as well do so at once, and note from the best estimates we can get that the total dollar volume of new building was 58% less in 1932 than in 1931. An independent calculation based on reported equipment sales in comparable groups shows a falling off of 51%. The close agreement of these figures lends strength to the belief that the indexes are reasonably reliable even though they do not restore the business, or salve the wound.

As the year's business has so many interesting aspects, and as enough information is available on which to discuss trends, a separate section is devoted to it and appears in later pages. In that section are facts and figures gleaned from a number of sources for those who take their statistics straight, and also a collection of information on trends of various sorts. Reading this section will let you get a picture of changes in building types, costs, equipment sales, fuels, and some interesting information on sales and distribution methods.

The Weather

As though the decline in general business were not enough, our usually reliable ally, the weather, also deserted us for a part of the year. Not only was the 1931-32 heating season one of the warmest of record generally, but the summer was cooler than average. While two years ago the heating season was only 6% warmer than average, the '31-'32 season was 18% warmer. As the year closed, though, we received help in the way of cooler weather, and the heating season of '32-'33, up to December, was only 7½% below normal. We seem to have found an upturn finally. So, during the year we had not one difficulty to face like other industries, but we had a second, all our own, with the weather deserting us.

In spite of this combination against us, we have some solid achievements to record, and let us now turn to these favorable items.

Interesting Installations

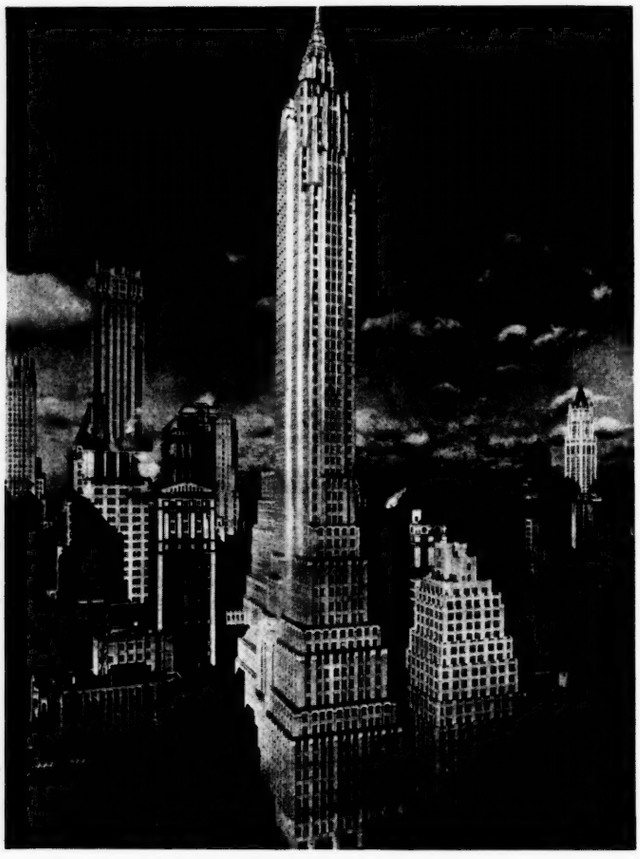
The year saw several installations made which are of more than ordinary interest, because they were off the beaten path and because they included features which were more or less innovations. Among these we include (a) Rockefeller Center, because of its sheer size, and because of the exacting nature of some of its air conditioning requirements—size and exactments not likely to be soon repeated; (b) the Cities Service building, because of its use of a new design of heating surface and hot water as the heating medium, and (c) the district heating project at Duluth, because it was put through during a depressed period by private resources.

Society Activities

Three American technical societies carry on work of interest to us, viz., the A.S.H.V.E., the A.S.M.E., and the A.S.R.E., and we must include their programs of the year in our review. All of these organizations experienced the troubles of the period of depression from which no one seems to escape. All, however, are carrying on, determined that their essential work shall not fail.

Notable in the year's events of the A.S.H.V.E. was the report of a committee appointed to draw up a set of standards of ventilation. The standards finally appeared in a brief form, and after discussion were referred to the membership at large for vote. The proposed standards as submitted received a majority of the vote cast, but a sizable number dissented. Following this, the whole subject of standards for ventilation was referred to the American Standards Association for action under its procedure with the A.S.H.V.E. acting as sponsor group.

National and local meetings were carried on as usual during the year, as was the committee work. Code preparation proceeded. The research activity continued.



One of the year's outstanding heating installations is the hot-water system in the Cities Service Building, New York

An amendment to the constitution cleared the way for a reduction of dues which was announced near the close of the year to be effective in 1933.

During the year, too, a committee appointed to revise the constitution reported with a comprehensive revision which is now in the hands of members for action.

The A.S.R.E. carried on its committee work and meetings as usual. Perhaps the most outstanding event of its program was the appearance of its Data Book ofter a long period of preparation. The cooling phase of air conditioning received considerable attention in the papers of the society.

At the annual meeting of the A.S.M.E. several papers on fan testing were presented. A proposed code for testing fans which would make use of a nozzle in addition to a pitot tube measurement appeared and was discussed. This society also studied, through its Pure Air Committee, the subjects of smoke abatement and air pollution. Through this committee, conferences have been held with representatives of the steel boiler and stoker manufacturers on the subject of boiler setting heights for heating boilers. The society finally voted late in the year to turn this matter over to the American Standards Association for action under its procedure.

The Year's Research Work

Here is the activity which fell off least during the last 12 months, if our information is correct. So much was done, and so many projects were carried on, that we have had to outline this work separately. The summary appears on page 20. We believe that you will agree that the volume of research in heating and ventilating is surprising, and that the trends shown will prove of interest. If you want a comprehensive look at the year's research, don't fail to read this section.

Publicity

Like research, publicity in some of its aspects often deals with intangibles and the man interested only in the day's work is all too often disposed to pooh-pooh its power and to dismiss it as worthless. Nevertheless, it has its practical uses and among these are the stirring up and nurturing of interest, often long before any tangible results are forthcoming. Often, too, like research, publicity must of necessity precede applications, and indeed it is a sort of intermediate stage between the two. First, research to uncover the principles and the facts; second, publicity to acquaint the public with them, and then demand and practical application, is rapidly becoming more and more the accepted formula.

For years many bewailed the fact that the ideas of heating and ventilation had never struck the popular fancy, while others less worthy basked in the limelight. Beginning slowly about two years ago this situation changed, until 1932 saw one of the ideas picked up and bandied about by publicity writers until even those most ardent for it must have been satisfied with the volume, if not with the quality. The astonishing "build-up" given to air conditioning during 1932 can be put down as one of the year's Events.

As reviewers, we can note, both some of its earmarks and some of its effects, although it is still too early to try to judge what the long-time effects will be.

Much of the publicity was of the usual kind; that is, it was both good and bad. Copywriters seized on a few facts, and exercised their talents at romanticizing. They foresaw all kinds of things from windowless buildings to a time when the humblest citizen would not only be a social outcast but a health-broken derelict unless he dwelt in an air conditioned house. They visualized markets ranging all the way from four to nineteen billions of dollars, and back again. Things reached a pass where market estimates of anything short of a billion were to be sneered at. The wave reached its crescendo in the spring and ebbed. The "build-up" had passed. Publicity had done its stuff on air conditioning. The year's closing months saw less and less of it.

Now, as reviewers of the year, let us inquire soberly just what the tangible effects are so far.

There are three that can be recognized at once. First, it did arouse the public's interest and carried some information to the ordinary man which he had not possessed before. Second, it aroused the interest and attention of financial and manufacturing interests. Third, the mammoth markets of the prophets did not materialize.

The second of these results bore fruit during the year in that those whose interest was stirred up often did something about it, and a number of the equipments which appeared can no doubt be traced to the attention

directed at air conditioning by the work of the publicity men.

The ultimate effects of the first result cannot yet be evaluated. Nor do we need to feel downhearted because the markets have not yet been found. Air conditioning still holds just as promising a future as ever.

Another subject received much publicity during the year and, like the other, the tangible results are not yet at hand. This was the publicity given to the housing situation in this country. It probably received more concentrated attention during the past 12 months than in any other like period. Partly as a result of this, not only are many housing projects being discussed but much concentrated work is going on quietly to try to find cheaper building methods and more satisfactory financing than have been available heretofore. Evidences are the specialized houses being erected in some localities and the plans for mass housing and extensive modernization of buildings. In all of these, heating and ventilating appear to be attracting more attention and commanding more respect than ever before.

The result of the year's publicity is a net gain to engineers and contractors who will share in its ultimate effects. We should all be glad that at last heating and ventilating has come into the limelight to the extent that it has, and should hail 1932 as the year that saw it reach a peak, even though we do have to smile at some of its foibles.

Legislation

The year saw no legislation of direct importance passed and approved except that which increased the funds for the Federal building projects and the acts authorizing home loan banks and emergency relief construction loans. From the first of these we have all benefited in that the Federal building program has made business, and accounts for no inconsiderable part of the year's building. When the year closed no tangible results from the passage of either the home loan bank bill or the emergency construction had come to pass.

Much of the good which might have been brought about by the Federal building program was nullified so far as contractors are concerned by the vicious practice of letting contracts for the mechanical equipment in lump sums and through general contractors. This resulted in ruinous bid peddling which demoralized prices and the only justification of which is the rather dubious one of resulting lowered cost to the government. Joint bills were introduced in Congress to compel the separation of the equipment contracts but were still pending before that body as the year ended.

Early in the year the New York legislature passed a bill abolishing the numerical requirements in the school ventilation law of the state, but the governor disapproved it. At this same session an attempt was made to pass a law providing for the pre-qualification of bidders and the licensing of building contractors, but it failed of adoption.

While this initial move looking toward licensing of contractors failed, the laws governing licensing of engineers were extended, and the minimum requirements for registration were made stricter in several states.

Building code provisions are always a matter of intense interest and while we have no reports of any radical innovations occurring during the year, a committee presented a revision of the New York code which contained extensive changes. It had not been acted on at the close of the year. It is reported that the uncertainty about the adoption of this code is not only holding up building in New York but elsewhere, as it is expected that if the code is once adopted in New York some of its provisions will be widely copied. No one

The largest air conditioning job of the year is that in the 70-story R.C.A. Building in Rockefeller Center. Fifteen miles of ductwork distribute the air to nearly 1000 outlets in the conditioned spaces of the National Broadcasting Company.

wishes to take the risk of erecting a building whose construction may be outmoded shortly.

The record of the year is thus largely negative in legislative matters, but the groundwork was laid for acts which may pass in 1933 and go to strengthen the position of the industry and its members.

The Trade Associations

These groups have accomplished work of outstanding importance and of a volume not likely to be appreciated unless you read carefully the record set down on page 23. The trade associations have become important not only in their influence on trade promotion, customs, and practices, but their efforts in support of research and standardization are impressive when brought together.

New Equipment

None of us can afford not to keep up on new equipment as it comes along, but do you know how much of it appeared even in a poor year? It shows trends which have a definite meaning and which are not readily comprehended unless you follow the grouping and discussion which appear on page 27.

The Prospects

We may as well admit that we are facing a new year about whose prospects we know nothing. We all hope that it may see a revival of business. If we enter it with depleted resources in the way of money and profits, it is equally true that we enter it with a record of past accomplishment of which we may be proud, and with noticeably better working tools in the way of improved knowledge and with a firm foundation laid. No industry or commercial group has better future prospects, none has more to offer in the way of innovations, none has a better background of recent favorable publicity, and when the clouds do lift we will be in a position to cash in, to some extent at least, because of the accomplishments of 1932.

The Year's Business—

Trends, Volumes and Sales

REVIEWING the trends in business the past two years, we are somewhat in the position of an army determining its casualties after an engagement. What have been the results, and at what cost have we maintained our position? Although the picture in retrospect is discouraging, there are bright spots here and there which indicate that the industry is putting up a courageous fight in the face of tremendous difficulties. Further, a study of our accomplishments reveals some interesting trends well worth attention. There is the possibility, frequently mentioned recently, that if business in general had paid more attention to an analysis of its position, we might not now be experiencing the grief which has come our way.

First, we might briefly study the trend of general business. By 1925 we had well recovered from the post-war depression and the wave of speculation had not yet assumed considerable proportions. Consequently, if we call 1925 normal, and business activity during that year 100%, then the first month of 1931 found business as a whole about 75% of what it was six years before, while building activity was 73% of the 1925 average. By March, 1931, business had picked up to 78%, as shown in Fig. 1, while building rose seasonally and actually exceeded the 1925 average, reaching 119%. It is hard to believe, but compared to 1925, building in 1931 actually averaged 88.3%, while business in general could only maintain a 74% level.

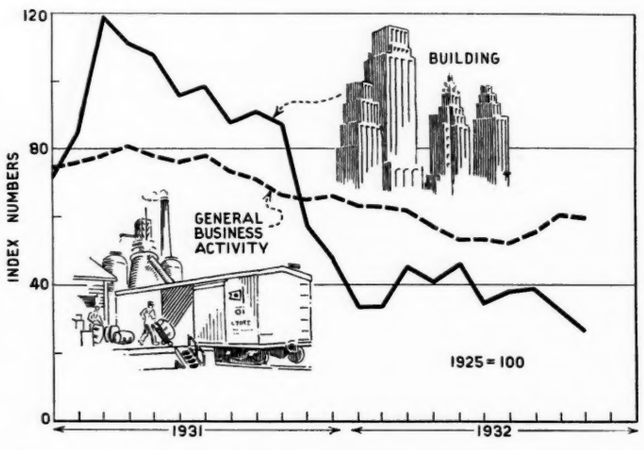


Fig. 1. The trends of general business activity, and of heating and ventilating business, 1931-32. 1925 average as normal

The year just passed, however, really brought trouble to the building industry, as is well brought out by the graphs in Fig. 1, where it will be noted that the curve for building fell rapidly during the closing months of 1931, and during 1932 maintained an average of only 37% of the 1925 average.

Final reports for November, coming in as we go to press, detract from the gloominess of the closing months and hold some promise for the future. The unexpected happened. Preliminary estimates indicate that building rose to 30% of the 1925 average. To be sure, this slight gain looks only mildly encouraging on its face, but the important point is that in only three years since 1914 has November building shown an increase over October.

Briefly, then, building more than held its own in 1931, but failed to maintain its position during 1932.

Generally speaking, as building goes, so goes the

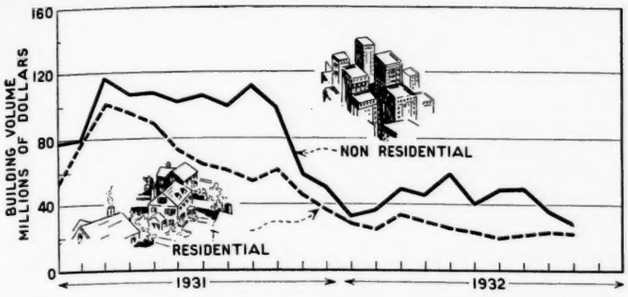


Fig. 2. Non-residential maintained its lead over residential building in 1932, as well as in 1931

heating and ventilating industry, and the building curve in Fig. 1 shows, in general, activity in this industry, as well as in building.

Trends

More detailed study of building during '31 and '32 reveals some interesting trends, among which the following merit mention:

1—The relation of non-residential and residential building. Fig. 2 shows the trends of the dollar volume of these classes of buildings. The chart must be interpreted with care, however, for the actual totals show that non-residential building dropped off from 1931 less than did residential, the declines being 58.6% and 66%, respectively. In 10 months of 1932, $424 million were spent for non-residential and $248 million for residential building.

Non-residential is taking up more and more of the total building volume. The following tabulation shows this clearly, the second column being the percentage of total building volume in dollars devoted to non-residential building:

1925	44.5%
1926	47.0%
1927	47.8%
1928	46.0%
1929	55.3%
1930	61.6%
1931	57.6%
1932	62.6%

2—The relation of public building to other non-residential building. As shown in Fig. 3, public building is assuming a more and more important part of non-residential building. In fact, the total amount of public building during 10 months in 1932 came within 29% of equaling the total of all other types of non-residential building combined. Public building, as the chart clearly shows, declined less in 1932 from 1931 than did other non-residential construction, the drop being only 5.9% for the former and 69% for other non-residential.

The small drop in public building as a whole was caused by fall-off in construction financed by the states, this building being off 30% in '32 compared with '31. Federal building, due to the emergency relief act of Congress last winter, actually increased 7.7%.

3—The relation of modernizing to new building. Although modernizing (additions, alterations, and repairs to buildings, including heating) fell off during the past year in total volume, it did not fall off as much as new building. The drop in modernizing was in the neighborhood of 44%. Relatively, modernizing increased in importance, this being shown by Fig. 5.

4—Activity in different classes of buildings. The decline in new building varied considerably among the different types of building, as follows: (The figures show the decline in dollar volume for the first six months of 1932, as compared with the same period, 1931).

	Percentage Decline, Dollar Volume
Single-family dwellings	67.1
Two-family dwellings	72.6
Apartment houses and flats	87.7
Theaters	26.0
Churches	40.8
Factories	73.8
Public garages	78.0
Institutions	61.9
Offices	92.5
Schools and libraries	52.8
Stores and warehouses	63.7

Building Volume Compared with Heating and Ventilating Business

We have found that residential building is off 58.6% and non-residential building declined 66%. This, however, is not the whole story. Building material prices dropped about 9½%. Wage scales were reduced throughout the whole building industry. The result was that the cost of building decreased, so that even if the same number of buildings had been erected during the year as in the preceding year, the dollar volume would have been less. Actually, averaging the cost of erecting six different types of buildings in September, 1931 and 1932, we find that this reduction in building costs was 7.6%. A calculation of the total building volume which includes this correction shows that *the total building volume in 1932 declined 58.1% from 1931.*

What we are more keenly interested in, though, is the record made by the heating, ventilating and air conditioning industry while building was undergoing such a drastic drop.

There is no better way to approach this than by studying the available sales figures of apparatus, reducing them all to a comparable base. Equipment is

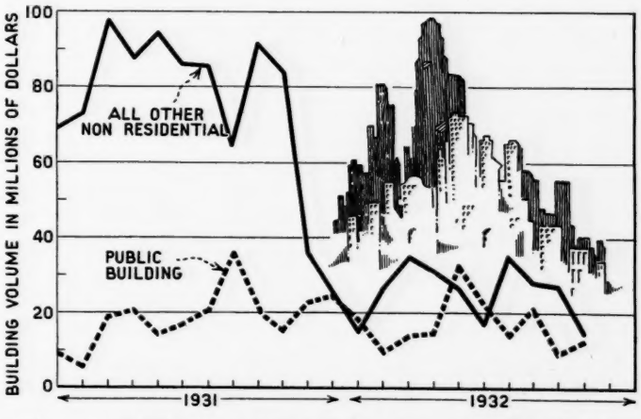


Fig. 3. Relatively, public building has gained until it is almost as large a market for building products as all other non-residential building combined

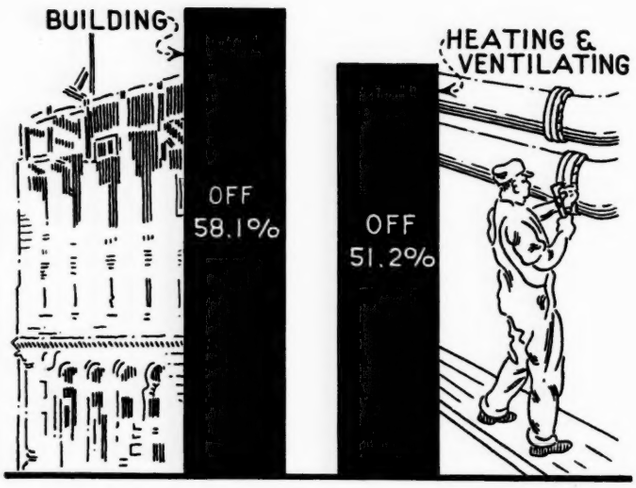


Fig. 4. The volumes of business done in both building and heating and ventilating dropped off in 1932 from 1931. As adjusted for changing values of the dollar, our business is off less than building

as reliable an index of activity in this industry as is possible to obtain, for the amount of work done by engineers and contractors is almost directly proportional to the sale of equipment.

With this idea in mind, reducing all of the equipment sold to equivalent units—dollars—and making a further adjustment for the drop in prices which took place during the year, we find that the total sales of apparatus for which we have record amounted to $62 million in 1931, as compared with $30 million in the same period of 1932. Thus, *the year's decline in heating, ventilating and air conditioning business has been 51.2%.*

The relatively better showing made by the heating industry as compared with the building industry as a whole is perhaps accounted for by the stress placed on modernizing. One heating contractor group through modernizing campaigns secured over one and a quarter million dollars' worth of business in 1931 from this type of work, and increased this in 1932 to over one and a half million dollars.

Sales of Heating and Ventilating Equipment

Few industries are more diversified in their character than the heating and ventilating business. Its equipment varies widely from such extremes as unit ventilators to oil burners. Sales of the different kinds of such equipments are a good measure of the progress, or lack of progress, in various lines.

Equipment sales are closely watched. It is in these reports that we can detect the beginnings of trends and the continuance or reversal of others. The merchandiser watches the pulse of buying so that he can get in on the ground floor of new buying habits; the manufacturer, so that he can switch his lines to new products, or reinforce his old lines; the contractor learns what others are installing, and so on.

For these reasons, a more or less detailed summary of equipment is included here. The information which follows compares 1931 with previous years. The figures do not necessarily include all manufacturers, but they do represent a good majority, and since they are comparable for both years, they are all of significance.

Oil Burners—Burner salesmen have a reputation to live up to, and even in 1932 they certainly lived up to it. In 1931, reporting companies sold 71,000 burners, and in 1932 only 19.6% fewer—a truly remarkable showing. This branch of the industry is to be congratulated for so impressive an accomplishment.

But this is not all. The oil burner business always has been highly seasonal in character. October sales are invariably the highest of the year and four months later the low point of the year is reached. Keen merchandisers of burners are always trying to iron out the peaks and to sell more burners during the winter and spring. Progress was made in this direction, for in 1929, February sales were only 1/6 of the October sales; in 1930 and 1931, they were only 1/5; while this year a little better than 1/4 as many sales were made in February as in October. The peaks are not yet ironed out, but the corners are surely being knocked off.

Another notable fact shown by the figures is that the natural draft burner continued to become a less important factor, relatively. In 1929, for every 100 mechanical draft burners 26 natural draft burners were sold. In 1932, this figure had dropped to 15 natural draft burners per 100 mechanical draft burners.

A slight trend was reported during the year in the way of the oil burner man taking on more of the character of the heating contractor. The tendency is slowly growing to consider him a heating specialist, rather than simply an oil burner man.

Steel Boilers—Sales of this product, amounting to 5200 units in 1931, are off 56.9% from 1931. An interesting trend is revealed by a study of the average size steel boiler sold each year, charted in Fig. 6. This average size declined steadily from 1920, when it had 671 sq. ft. of heating surface, until 1931, when the figure was 443. In 1932 this had dropped to 428.

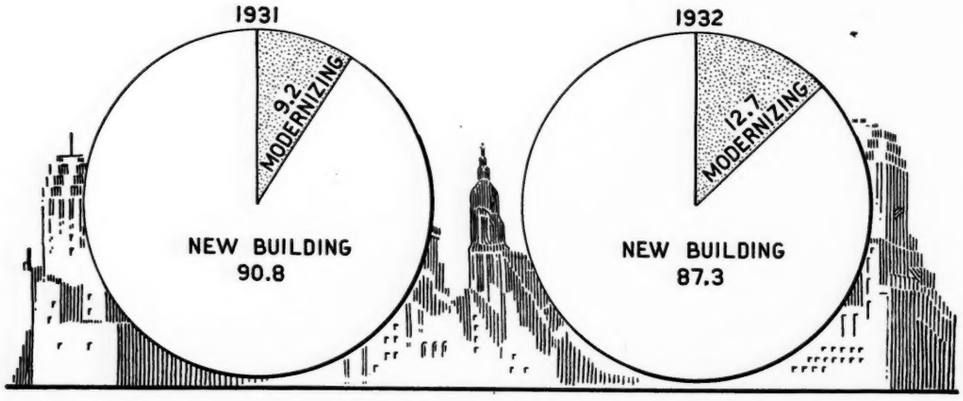


Fig. 5. Modernizing was a larger part of the building volume in 1932 than in '31. Money spent for improving buildings declined 44%, while all new building dropped 61%

One explanation of this may be that steel boilers are penetrating further into the smaller size type formerly monopolized by cast-iron units.

The race between steel and cast-iron boilers has for years been keen. With one of the country's largest corporations introducing an oil-burning steel boiler during the year, and with one of the largest burner companies announcing, in cooperation with a cast-iron boiler company, an oil-burning cast-iron unit, the competition promises to carry into the residential field where steel boilers previously have found little business.

Stokers—Nearly 10,000 domestic and commercial stokers were sold in 1931 for use in building heating plants. Although an infant industry, the stoker business has a strong start. Sales in 1932 showed a drop of only 10.8% from the preceding year.

Units burning less than 100 lb. per hr., the class which includes all the residential type, show only a small drop. In 10 months in 1931, 5582 such units were sold, while in the same period of 1932, 5555 were sold. Sales of the medium size class, burning from 100 lb. to 200 lb. per hr., declined from 1252 units to 772 for the 10-month periods, while the large sizes dropped from 887 to 472.

Fans and Blowers—This group includes fans for mechanical draft, large blowers for ventilating systems, and the small propeller-type exhaust fans. Sales are off 50% from last year—a decline practically uniform through the whole range of types, with the exception of mechanical draft fans, which were off only 30%.

Radiators—Shipments of cast-iron radiators dropped 45% from last year, when 71 million square feet were installed. Monthly shipments of this equipment are plotted for eight years in Fig. 7.

Prior to a month ago, little was known, except by manufacturers directly concerned, as to just what extent *convection-type radiators* were encroaching upon the cast-iron radiator business. The following table shows this information for the eight months for which data are available:

For the period covered, sales for convection-type radiators were slightly under 10% of those of the usual cast-iron type.

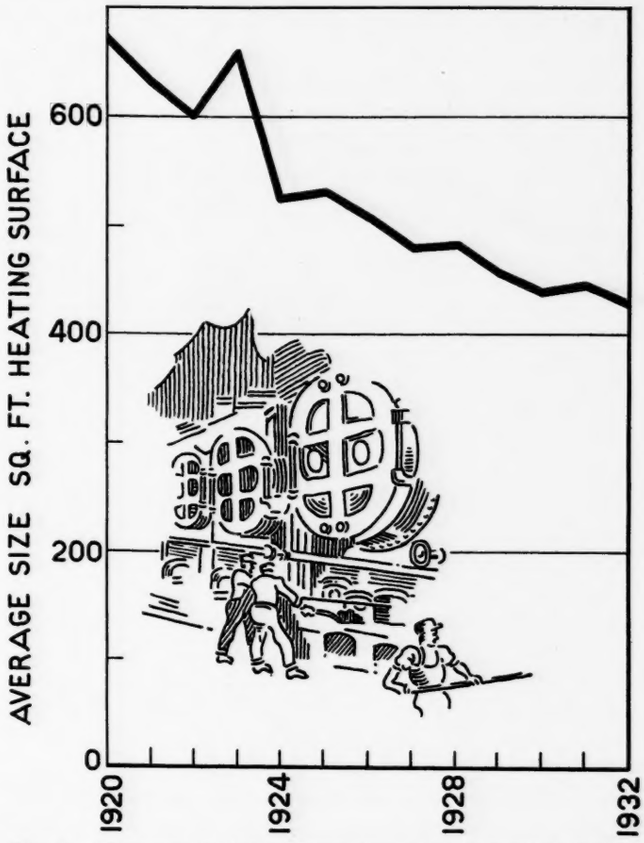


Fig. 6. Decrease in the average size of steel heating boiler

	Elements Only, 1000 Sq. Ft.†	With Grilles and Cabinets, 1000 Sq. Ft.†	Total 1000 Sq. Ft.†
January	75	257	332
February	95	212	307
March	78	191	269
April	80	209	289
May	61	218	279
June	97	191	288
July	81	196	277
August	155	165	320
Total	722	1639	2361

†In equivalent cast iron

Cast-Iron Square and Round Boilers—An interesting comment on the figures for these two products is possible. It appears that with the introduction of the

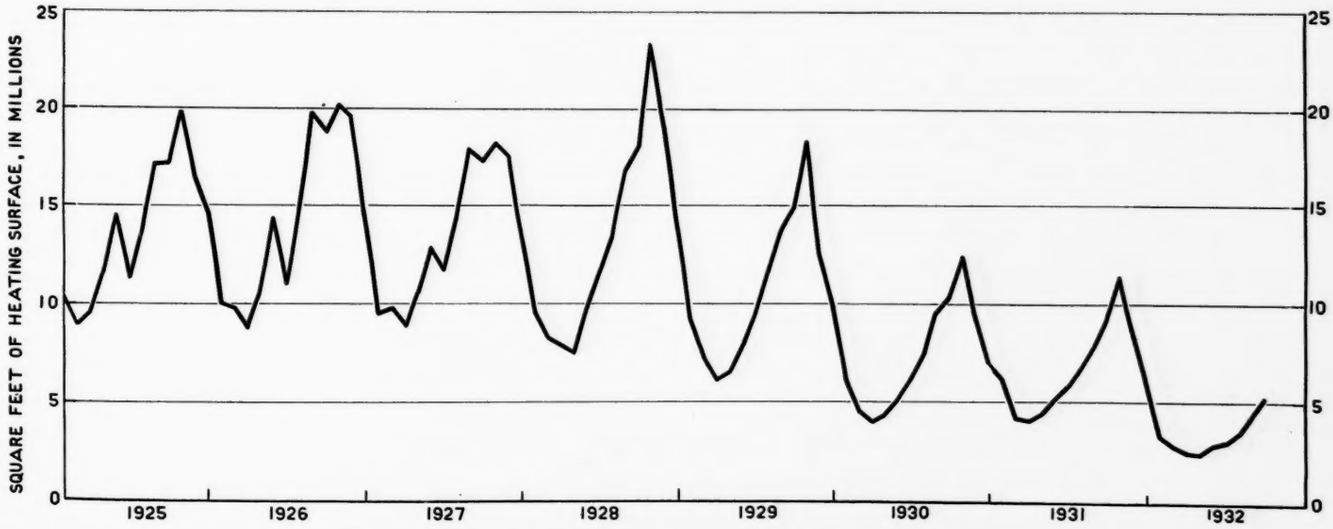


Fig. 7. Shipments of cast-iron radiators, by months for 8 years

jacketed square boiler, the quantity of round boilers began to drop. For 1932, as compared with 1931, the drop in square boiler sales was 26.8%, and for round boilers 47%. A calculation showing the drop for the year compared with 1928, shows that round boiler sales are off only 11 more than the square, clearly indicating that the decline in round boilers is becoming more and more marked.

Unit Heaters—Even in the poor year of 1931, manufacturing of industrial unit heaters was a three and a quarter million dollar industry. Sales for 1932 were off 58.7% from the previous year. Industrial building, however, is off 74%, so that in view of this handicap, this product has fared well.

Unit Ventilators—A sharp drop in sales took place in this group, the loss of 65% being somewhat greater than the decline of 53% in school building.

Gas Boilers—No data are available as to the value of conversion burners manufactured, but gas boilers alone were valued at nearly $2 million in 1931. Sales of these boilers dropped off 59.7% in 1932, as compared with 1931.

The conversion burner seems finally to have found favor with the manufactured gas companies. The increase in these units installed by such utilities last year was 29%, or double the increase in gas-designed apparatus. On the other hand, in the natural gas territories, the conversions increased only 20%, one half the increase of straight gas equipment. However, conversion equipment in point of numbers still dominates the natural gas jobs to the extent of 70% of all installations. Gas-designed equipment makes up 88% of all jobs on the lines of manufactured gas companies.

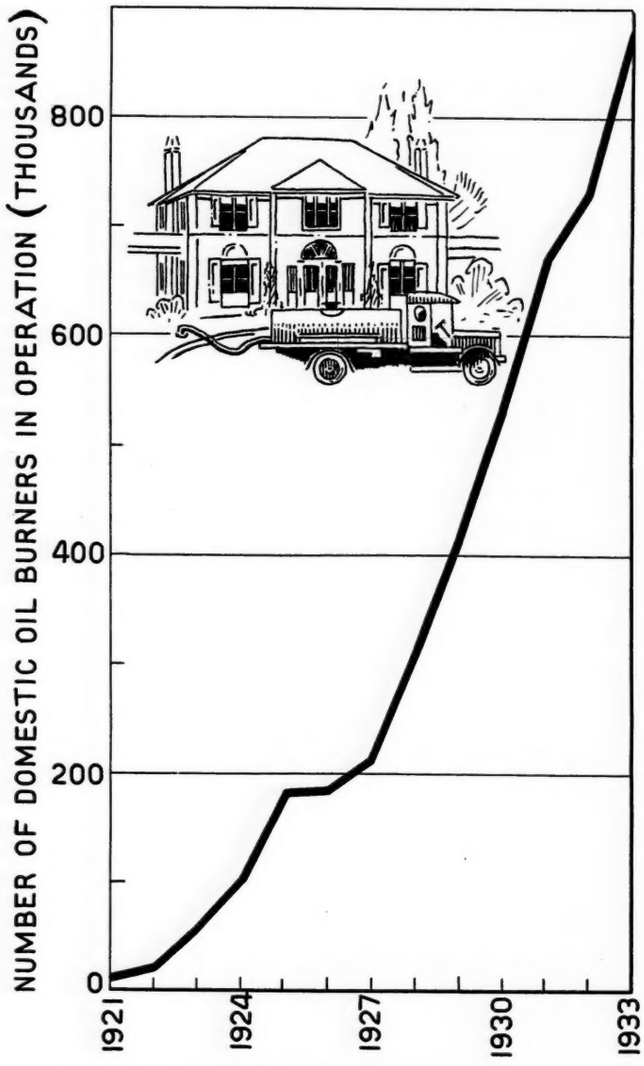


Fig. 8. Number of domestic oil burners estimated to have been in operation on January 1 of each year

Progress is being made in obtaining further cooperation between the gas utilities and the heating contractor. A sub-committee on sales plans and policies of the A.G.A. has recommended that the utilities sell gas-fired equipment to the contractor at the net trade price and deliver equipment to the premises where it is to be installed.

Indirect Heating Surface—Indirect surface of all types fell off 70.3% from 1931, copper and aluminum types making the best showing, with a decline of 52.2%. Cast-iron surface dropped 53.6%, while steel pipe coil fell off 82.8%.

Unit Air Conditioners—This apparatus, designed primarily for industrial purposes, reported an increase of 11.1% over 1931, accounted for by extraordinary sales in one month last summer, the sales during the month being 2½ times as great as any month last year, and considerably higher than the sales reported for any previous month. The sale of air washers was off 52.7% from the previous year. Total sales of units and washers amounted to one and a quarter million dollars in 1931.

Other Air Conditioning Equipment—During the past year, the two largest air conditioning jobs in the world were announced—one in the broadcasting studios in Radio City, New York, and the other in one of the government buildings in Washington. Production figures on small equipment, such as warm-air units, are not available. Neither is there any record of the total sales of mechanical room coolers, ice room coolers, etc.

Some isolated data are available, however. The electric utility in Chicago promoted an air conditioning show last summer and gave it considerable publicity in the city and nearby territory. The show resulted in 126 sales, made up of 66 ice coolers, 40 cooling fans, 13 humidifiers, 3 filters, 2 furnace conditioners, and 2 mechanical room coolers. It was reported that one of the largest companies selling mechanical room cooling in Chicago, with nine salesmen employed, sold 13 coolers during the year. The ice industries, while not reporting in detail, had record of 78 permanent installations made this year, an increase of 400% over last year. Of the year's ice-cooled installations, theaters lead in the type building conditioned.

Conditioning made considerable headway with the railroads during 1932. We have record of seven roads which placed ice-cooled cars in service during the year. Several others adopted mechanical systems, at least two having inaugurated during '32 complete trains with conditioning.

Utilities in St. Louis, Chicago and Detroit have lent cooperation in promoting air conditioning. The ice dealers are not all cooperating in attempting to sell ice

for conditioning, but many of them are, and progress was made by this group during the past year. One of the coal organizations is investigating the use of silica gel for use in connection with coal for conditioning.

So far as the combined sales of all such equipment go, the only available figures are estimates. One such estimate is that all air conditioning equipment sold during 1932 amounted to $9 million.

The distributuion channels for the small air conditioning units, however, are in a confused state, and no definite trend was discernible during the year. One large manufacturer has set up his own distributors who, in most cases, will sell nothing but the company's line of conditioning equipment. One of the oldest air conditioning manufacturers in the country, who handles his own installations, has announced a change in merchandising policy, at least for the small units, providing for sales through dealers and contractors. Oil-burning conditioning equipment is slowly being taken up by the dealers who handle burners. In some cases, the electric refrigerator people are the retail outlets handling small conditioning units. The warm-air type units are being sold by gas utilities, sheet metal shops, oil burner dealers, and others. There is no single group which can lay claim to a monopoly on the business of selling air conditioning.

Possibly the biggest single event during the year in air conditioning was the entrance of some of the country's largest corporations into the domestic conditioning business. Other events include the shows put on by utilities and the air conditioning conferences—one held at the Case School of Applied Science, and the other at Michigan State College.

Fuels

Comparisons of the year's business in the sale of fuel are difficult for two reasons. First, the heating season begins at the close of one year and ends in the middle of the next. Second, with the exception of gas, fuel figures are not available for many months after the year has elapsed, and in the case of coal, it is practically impossible to determine what percentage of the total sold is used for building heating. The weather variable further complicates the matter.

A weighted comparison of degree-day figures for a number of large cities shows that the first 11 months of the calendar year 1932 were 6% colder than the same period last year.*

Oil—There were an estimated 669,000 domestic oil burners operating at the beginning of 1931, and 773,000 at the close. At the end of 1932 there will be an estimated 876,000 burners in residences. Consequently, making an allowance for the change in weather, it is estimated that the domestic burner oil consumption for 1932 will be nearly 30 million barrels, as compared with somewhat less than 25 million barrels in 1931.

About 16 million barrels of oil were used by commercial burners in 1931. It is almost impossible to make an estimate as to what this figure will be for 1932, but it will probably be close to the 1931 figure.

Coal—The continued inroads of the oil burner and gas-fired equipments undoubtedly further affected coal consumption for building heating. In point of numbers, the stoker is still relatively unimportant, and even where they are installed the majority are in plants which previously burned coal. The total tonnage for any one year is not known. It is highly improbable that competitive fuels decreased coal consumption as greatly as the colder weather increased the consumption (as compared with 1931). Therefore, we can expect that coal consumption for 1932 may be somewhat greater than in 1931.

Gas—There was an increase of 14% in the number of installations of heating jobs burning manufactured gas from July 1, 1931, to July 1, 1932, and a gain of 28.6% in natural gas territories. The former showed an increase in gas consumption of 2.8% over the previous year, while natural gas consumed rose 17.1%.

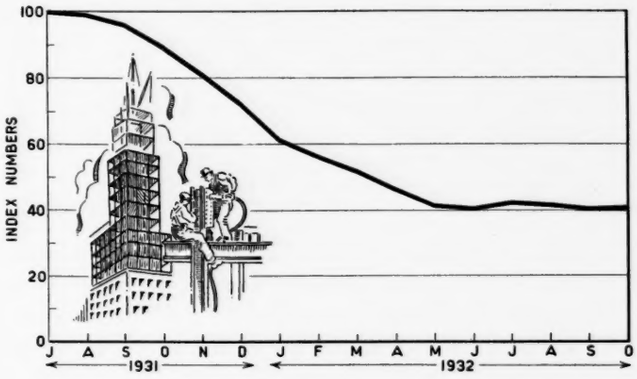


Fig. 9. Trend of employment in building construction

General Conditions

Employment—It is not pleasant to report that unemployment in the industry is one of the few items which increased during the year. For every 100 men employed in building construction in July, 1931, there were only 61 employed by New Year's, 1932, and only 41 by October, 1932. This is shown in Fig. 9.

Employment in manufacturing plants making steamfittings fared somewhat better than that in building construction. For every 100 men employed during 1931 in these plants, 69 men were employed, on an average, during 1932. For every dollar paid to employes in 1931 in these plants, 56 cents were paid in 1932.

New York state reports that for every 100 men employed in October, 1931, in plants making heating and ventilating apparatus, there were 70 employed in October, 1932. This state also reported some encouraging figures at the close of 1932, in that general building contractors in that state employed 2.4% more men in October than in the previous month, and heating and ventilating firms were among the few sub-contractors showing a net gain for the month.

Wages—While union scales held up in some cities, the scale does not necessarily represent usual prices over the whole country. The medium rate for steam-

*Note: The heating season 1931-32 was considerably warmer than the previous year and than the normal. The colder weather this past fall has increased the figures for the calendar year 1932 above those for 1931.

fitters in 214 of the larger cities, as of November, 1931 and 1932, shows a drop from $1.25 to $1.02. The union scale for sheet metal workers averaged for 10 large cities dropped during the past year from $1.27 to $1.14.

Prices—The action of prices in our industry during past years is well known. A comparison of the price trend of heating equipment as compared with other products brings out some rather unusual points. The following comparison is based on the average price in 1931 and 1932 of one dollar's worth of goods in 1926. The *all commodities* is an average of nearly 800 products covering everything from food to furniture. The *building materials* figures are for a large number of products, such as lumber, and including heating and plumbing, which enter into the construction of buildings.

	Cost in 1926	Cost in 1931	Cost in 1932
All commodities	100 cents	73 cents	65 cents
Building materials	100 cents	79 cents	71½ cents
Plumbing and heating....	100 cents	85 cents	67 cents

Thus, heating and plumbing prices, while holding up well in 1931, fell faster than other building materials in 1932, although the level is still slightly higher than that of the average of all commodities.

Research Work of the Year

NOTHING definite is available whereby an estimate of the extent of research work during the year can be ascertained. No agency or clearing house is in existence whose business it is to secure such facts and make them public. Any statement as to the extent must therefore necessarily be an estimate.

While our evidence is admittedly incomplete, we do have some facts which lead to the belief that, while there has been a considerable falling off in the amount of money devoted to this work, it has fared much better than general business throughout the industry.

Evidences showing a falling off are the known fact that many individual companies have greatly reduced their research staffs and their appropriation to this work in their own organizations; that college and university budgets to research have been lowered; that in the trade groups some have had to decrease their support because of smaller income, and that the research budgets of the technical societies are reported as having been cut sharply.

To offset some of this it should be recalled that volume and results do not necessarily fall off in proportion to budget reductions, for there have been decreases in material and salary costs, and the same budget will support more work than was possible a few years back.

Another evidence of increased activity lies in the reports which continue to reach us that individual companies are quietly working on new designs and inventions which they are preparing but not announcing, as the time is not considered ripe. This kind of work is especially hard to estimate in terms of volume, but we feel that it amounts to considerable in total. With the increased attention being given to heating and ventilating, both as a result of the favorable publicity of the past year, and because of the desire of many organizations to hit upon a product to extend their lines during these troublesome times, there has been a considerable influx of manufacturing organizations, most of whom have had to do product development work. All this goes to swell the total.

Another notable tendency has been the growth of field research—often financed by a private organization or group. Several newcomers have started this work and it increased the total volume.

In spite of all this evidence pointing toward increase, we believe that the year saw a net reduction of activity in research work.

There are several interesting angles from which the work can be examined. Among them is that of trends. Were there any distinct trends to be noted or any especial tendency toward either particular subjects or particular methods of carrying on the effort?

Field Research

In this connection, the subject of field research is worth discussion. During the year several field studies of interest and importance were either undertaken or accomplished. Among these were the ones of the Detroit Edison Company in some of its stores and in its residence near Detroit. These have to do with methods and costs of cooling. Those at the Urbana research residence are really a continuation of a long-standing project which turned toward cooling during the past summer. Several other residences are reported to have been used for the study of this problem but were under private direction, and results are not expected to be made public. Notable, also, was the continuation of the studies of the gas association on cooling costs and methods.

In addition, studies are reported on the operation of several building plants, and the building owners and managers' organization continues to collect operating data, while the district heating association does the same. First operating results on the reversed refrigeration plant in the office building of the Southern California Edison Company were reported. In this connection we should not overlook the studies at Washington State College, where houses were operated with and without stokers, resulting in added information on their operation and cost.

All this known activity leads to the thought that the value of field studies as opposed to the laboratory type is being more widely recognized, and that the studies of the past year may be the beginning of a trend in that direction. Lack of dependable work of this kind has been a weakness, but its possibilities of usefulness are great. It is to be hoped that results will justify those who are backing these efforts to continue to do so.

While we are on the subject of field research, we must note that which consists of erecting buildings

using new methods, designs, and materials. The year saw a good deal of this, notable examples being the several steel houses, the one atop a New York building, and those using precast slabs and sections. None of these were erected to study either heating or ventilating primarily, but they all affect us in that they may in time lead to notable changes in our own practices.

Cooling

Interest in cooling was great during the year, and much of the year's research was directed to it. Along with this, there arose a demand for more and more authentic information about the whole subject of air conditioning, especially as adapted to small building spaces. Even in so short a space as a year much has been accomplished, and with so much activity to be carried forward, it is evident that there is a trend toward lifting the veil of mystery which so long hung over the subject.

Another interesting development of the year was the increasing interest of the electric utility companies in the load possibilities of air conditioning. With their ample resources, they are in an excellent position to collect data and to study any obscure phases of the subject. There are indications that they expect to pursue this policy with vigor.

Foreign Work

Research work on heating and ventilating in foreign countries does not reach great volume, nor do we have any record of any extension of programs during 1932. Most notable, and most closely related to our own work is perhaps that being done in England, although German and Swiss radiator tests were reported.

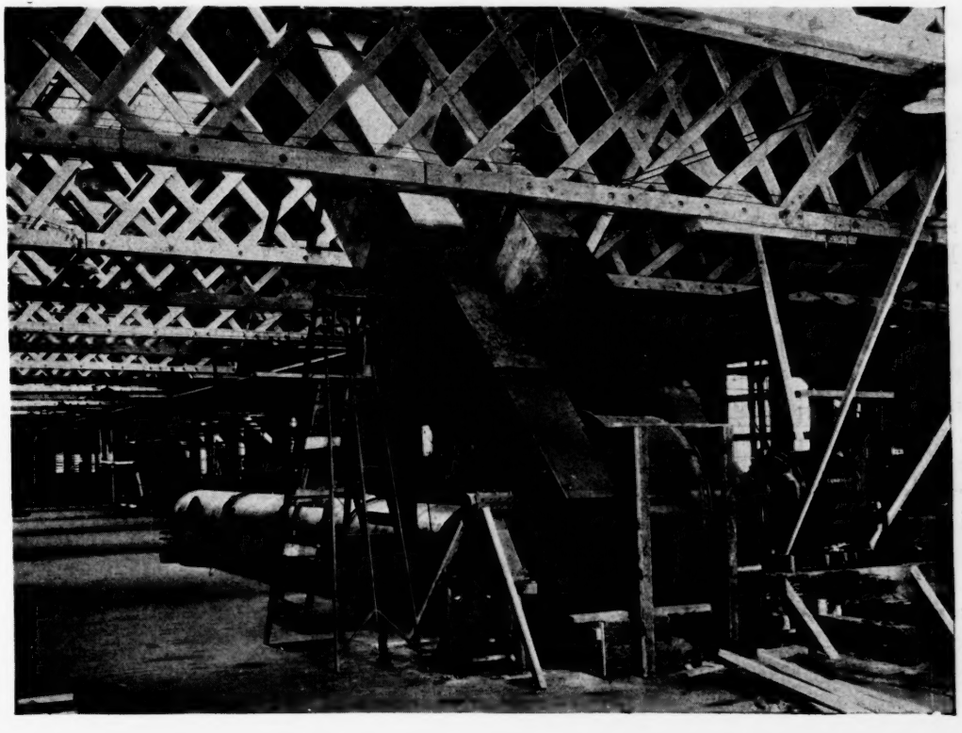
In England, the Building Research Board had developed facilities already, and continued to carry on studies. The work was along lines of attempting to learn the basic facts of heat interchange between the human body and its surroundings, and more especially the effects of radiant heat on this interchange. During the year, Vernon reported the results of studies made in rooms heated by radiant means and also on the effects of heat rays of various wave lengths on the feeling of stuffiness in rooms. His results showed that he could offset some of this feeling by waves from incandescent lights, as well as by air circulation.

Radiant Energy

This question of radiant energy in waves of various lengths is one which will not down. The Smithsonian Institution recently reported that it has been found that these waves have a considerable effect on the growth of plants. It is now well established, too, that temperature changes in the blood stream can be produced by some of them. While present studies are fragmentary, it is probable that eventually we will see a greatly increased interest in radiant energy. Studies of the effects have been proposed in this country, and the small beginnings made during the year foreshadow a trend in fundamental research work in this direction.

This same general subject is receiving attention in relation to its effects on heat flow through building materials. Radiant energy from the sun is coming to be more and more understood in its effects on the summer cooling loads of buildings. Studies at several places in this country during the past year showed that surface, colors and finishes affect the quantities, and that flow through building walls could be lessened by the use of foils and thin sheets placed in air spaces. Data are now available which permit evaluation of their effects, and constructions involving their use are already announced.

Heat flow through building walls and constructions is a subject which has interested research workers for many years. Some of the oldest researches made on heating and ventilating were undertaken to find constants and coefficients for practical use. These were always made under conditions of steady flow and the information built up has probably had more lasting effect on practice than any other set of figures ever brought into existence. It has been apparent for a long time that this method was subject to a large error, but nothing was done about it. Attempts were made to study actual flow some years ago, and continued during the past year. They may produce results which will eventually permit a new calculating method. Acceptance of this idea is becoming more general and the continuance of this work is worth noting for that reason if for no other.



Fan testing laboratory at Harvard University, Cambridge, Mass.

Fuels

The fuels used are always an important part of a heating installation and any advance made in technique quickly affects practice. Ever since oil and gas started to make inroads, there has been much interest in the fuels and in their application to heating. The interests concerned primarily with the use of each are now well organized and are carrying on aggressive promotion. Among their activities are those of research.

Principles governing the burning of the fuels, which are the fundamentals behind their use, are now well known, and research on fuels no longer concerns itself much with principle study, but aims instead at applicational data. The research problem with all the fuels is how to apply them safely, cheaply, and in a way that will appeal to users, while observing the principles of combustion. Consequently, one would expect to find research moving along these lines.

In the case of gas, the principal drawback is still high cost. The problem is being attacked in two ways. First, finding devices and methods which will reduce cost to the owner under existing rates and, second, means of making rate reductions possible.

Improvements in efficiency and devices of lower first cost are aimed at an attempt to accomplish the first objective. Among the possibilities are the use of conversion burners and combination of heating and water-heating loads. Both of these are receiving active study.

Extension of the winter load to the summer offers a possibility of so increasing the annual load factor that it is being actively promoted, largely through studies to learn the facts about the use of gas for summer cooling and dehumidifying.

Oil as a heating fuel has found its principal use by installing burners into existing boilers and furnaces. Problems connected with this practice are not yet fully solved, nor are those which have to do with the effects of intermittent firing. Consequently, these problems received study during the year when laboratory tests started in former years were continued.

Other studies connected with the use of oil include those devoted to markets and marketing methods, and a study of the laws affecting the industry. This latter resulted in a valuable compilation which appeared during the year.

Research in coal is in a peculiar condition, in so far as the problem of utilization for heating is concerned. It has lagged behind what might reasonably be expected of so important an industry. It is not necessary to go into the reason for this, and it is sufficient to note that but little formally organized research work was carried on during the year. Some work is being done, however, toward improving the automatic operation and control of coal-fired equipment and toward improving service to coal users. Probably much of the effort which under other circumstances might go toward research is now going toward organization and improvement of retail distribution.

The laboratories maintained by the gas association and by the anthracite interests continued to function throughout the year. Both still devote a considerable part of their efforts to testing the performance of equipment.

The Agencies of Research

A review of the year must necessarily outline the work done by the several agencies. One way would be to give a list of papers, and reports resulting, together with a statement of the findings. This seems a rather poor way, though, for neither the amount nor the excellence of research can be judged by the number, or thickness, of published reports. Instead of a list, we will outline the work of the several agencies during the year, noting especially new projects or departures from previous practice. Four agencies did enough work to warrant considering them separately, (a) colleges and universities, (b) organized trade groups, (c) government departments, and (d) societies. The extensive work of individual companies cannot be outlined for reasons already stated.

Colleges and universities were embarrassed by lack of funds this past year. However, we have no record of any of those colleges which have already embarked on research projects, abandoning them. On the other side, announcements were made of two new projects. One is the establishment of a laboratory at Harvard where problems relating to fans will be studied, and where fan tests may be made. It was also announced that Yale will construct a laboratory in which ventilation studies will be made. This is said to be founded on a grant of funds from the Pierce Foundation.

Notable among the year's results are papers or bulletins from Illinois, Washington State, Penn State, Purdue, and Minnesota, although all of these are thought to result from work begun before 1932.

Work at the several institutes for research, including the Mellon and Battelle, continued using the fellowship plan. No changes in either policy or projects were announced.

Organized trade groups have come to take a considerable interest in research work in recent years, and continued this in 1932 in spite of conditions. The gas association and the anthracite institute tested applications among which were those for heating, while the warm-air group continued its support to the work at Illinois. The ice association contributed to building cooling studies with ice. The gas study of building cooling has already been mentioned. In addition, several other groups gave financial support to society research.

Among government agencies, the Bureau of Standards research fellowship on heat transfer was continued through 1932, while the Bureau of Mines continued to furnish shelter and services to the society laboratory at Pittsburgh. A publication of the bureau also appeared, which resulted from its studies on the use of various salts to clean out chimney flues.

Early in the year it was announced that the Public Health Service had undertaken a study of air pollution in 14 cities, but the results have not yet been announced.

Research work of the engineering society was hampered by the necessity of budget curtailments during the year. Shrinkage of income from dues and from contributions brought this about. No departures or innovations in policy were announced. Work was continued at the Pittsburgh laboratory, and early in the year it was stated that cooperative projects were under

way at eight colleges and universities, as follows: Minnesota, Texas A. & M., Illinois, Yale, Harvard, Carnegie Tech, Armour Tech and Wisconsin.

Papers resulting from some of these projects appeared as program papers of the society meetings. The society also took part in the cooling studies made at Illinois during the summer.

Two Independent Reports

Two reports appeared during the year which were not the result of the work of any of the groups so far mentioned, but which were of enough importance so that they must be noted. One was a more or less final report of the New York Ventilation Commission, and the other, the report of a study on the physical and chemical basis of corrosion in steam heating piping, made by the New York Steam Corporation.

When we look over all the research activities of a full year in one survey, two impressions stand out. One is the rather surprising volume of this work even in a year of lessened activity, and the other is the fragmentary nature of the information resulting. To secure the full benefit of the research results, one must still pick up an item here and an item there. In a way this is to be expected, but the full value is not yet obtained easily and without much detailed work. Many of these results are still buried, so far as actual practical usefulness is concerned, largely because no agency is at hand for fully compiling and correlating them in a critical and comprehensive way. We predict that the next major trend in research will be a move in this direction.

The Trade Associations in 1932

WE are fortunate in having a number of trade groups whose activities are always interesting as they touch upon particular phases of heating and ventilating in which their members' interests lie. These groups have become so definitely a part of the industry that a review of the year would certainly not be complete without reviewing their principal work.

The depression period has been a hard and trying one for all trade associations. In some industries these organizations have proved to be fair weather fliers only, but not with us. We know of no trade group in this industry which has dropped out of existence during the depression period. What better indication can there be of the high regard in which their work is held than that ways and means are found to keep their vital work going even under difficulties?

Nor does the course of events seem to have dampened their spirits. Everywhere the tale is the same—reduced budgets and curtailed activities. Everywhere also there seems to be a quiet determination to see the job through. We asked for information as to the 1932 results and received no gloomy statements. Instead, all were straightforward, brief and businesslike. So true was this that we can think of no better way to present the story than by using the words of these reports so far as possible.

Heating and Piping Contractors

Consider first some of the items of the tangible, workable program which the Heating and Piping Contractors National Association has carried forward during 1932.

In cooperation with the other two mechanical trades (electrical contractors and master plumbers) the association sponsored legislation for the separation of contracts for mechanical equipment in all Federal building work. As a result of this effort there are pending in Congress now two bills, H.R. 9975 and S. 4342, which provide for letting contracts for the three branches of the mechanical trades—electrical work, heating, and plumbing—separately. These bills in both the House and Senate were referred to the Committees on Public Buildings and Grounds, and hearings have been held in both committees.

Under the auspices of its Committee on Trade Promotion, the association assisted in the development of the modernization market by providing both through its bulletin and through merchandising campaign folders, specific and definite materials which are of value to the membership in selling this new field. During the year four merchandising campaigns were conducted—an inspection campaign conducted during February and March, a radiator heating campaign during April and May, a modernization campaign during August and September, and a specialties and accessories campaign during October and November. The last of these campaigns has just closed.

The association has been promoting the intensive development of the modernization market for two years. It began its program early in 1931. The results for 1932 show an increase in the amount of modernization work sold of 48% in number of jobs and 28% in volume as compared with the results in 1931.

Two committees were active in the development of materials for the use of members in the air conditioning field. The Committee on Standards developed technical data which will soon be published and distributed to the membership. The Committee on Air Conditioning has been concerned with studies of available apparatus and of methods of selling in the air conditioning field, and has provided a service which it is believed will be very useful to the membership. Under the auspices of this committee there is being published now in the Official Bulletin, a series of ten lessons, "Air Conditioning for Heating Contractors," which will later be reprinted as a handbook and distributed to the membership as a constant reference guide. There is also being published in the bulletin a series of equipment articles giving essential information concerning the design, construction, capacity, operation and servicing of

various types of equipment in the air conditioning field.

The Oil Burner Group

Then take the American Oil Burner Association, an organization representing a group which has enjoyed a better volume of business comparatively than have the others. To some extent this situation may help to account for the success which has met its efforts, but then it always was an aggressively managed outfit which carried its objectives pretty consistently.

The association has already completed its plans for its 1933 show and convention to be held June 12-16 at Chicago, which is expected to be the largest yet held, and to pay tribute to the decade of progress just completed by the oil burning industry. Thus, the association lays its plans well in advance.

During the year, too, meetings of both manufacturers and dealers were held as a part of the work of the association. Three such meetings in the form of forum conferences were held by the manufacturer members, and the dealer division conducted ten regional meetings of dealers in the interest of cooperative thought and in the development and maintenance of a higher plane of sales and service.

Among the more or less national issues in which the association took a hand to protect the interests of its manufacturer and dealer members were the subjects of the oil tariff and "free service." The association has also made substantial progress in the matter of trade practices, technical and market research, insurance company cooperation, and cooperation with the heating industry in general. Among such activities were the following: formulation of preliminary plans, through sponsorship of the Committee on Cooperation with the Heating Industry and Committee on Market Research into the boiler-burner trend; the completion of "Graded Oil Burner Markets," an analytical survey into potential markets for domestic oil burners by counties, states, and groups of states; final approval by the National Fire Protection Association and the National Board of Fire Underwriters of changes with respect to eliminating from their regulations and building code the special fireproofing requirements in connection with oil burner installations; completion of three-year technical research program undertaken at Yale University on burners and burner performance under the joint auspices of the A.O.B.A., the A.S.H.V.E., and the Yale school of engineering; promoting better ordinance standards as cases inimical to sales and installation arise; adjudication of complaints through the dealer division in the cases of dealer against dealer, branch office against dealer, customer against dealer; cooperation with the distillate burner manufacturers' association on legislation, complaints and other matters where the activities of the two groups seem to join; dissemination of informative material on oil heating among architects, building trades, industry and the public; working with the trade press to better standards of advertising, and the elimination of destructive price advertising.

In addition to "Graded Oil Burner Markets," the association developed other literature along lines believed likely to be most helpful and most useful to the membership, and to the heating industry in general. In this connection, the monthly American Oil Burner Dealer, and among other publications "This Gas Competition" and "A Digest of Law and Cases on Heating Systems and Devices" make notable contributions in the interest of informing the industry and in keeping it abreast with changing times.

The Coal Associations

The past few heating seasons have been mild, and those whose chief interest lies in the furnishing of coal have had this to contend with along with other little troubles like the depression. Nevertheless, the organizations are not only carrying on, but—and get this one for courage—the National Coal Association has actually found time to foster and formulate plans for establishing a research laboratory for bituminous coal. Research on the utilization of bituminous coal has lagged, but with this sort of courage in the face of trouble, the industry evidently isn't licked yet. The National Coal Association has also cooperated with the purchasing agents' association and with the standards group on working out a standard method of classifying and sizing coal. It has continued to give its support to the Committee of Ten throughout the year.

Probably most of us are more familiar with the work of the Committee of Ten Coal and Heating Industries than with that of the other coal groups. It was formed to promote the utilization of solid fuels through coordination of the efforts of coal and allied industries and related burning-equipment industries, to provide the utmost in consumer satisfaction.

The chief activity of the committee during 1932 was the compilation, publication and distribution of six educational bulletins, while other miscellaneous and unclassified reports were also issued on various subjects pertinent to the solid fuel industry. The educational bulletins which were written in non-technical language were widely distributed and covered such subjects as chimney construction, fireplace construction, certified heating, solid fuels in hand-fired plants, automatic coal heat with stokers, and comparative fuel data. The committee has laid its plans well, and not only proposes to issue further bulletins on combustion, air conditioning, smoke abatement, heating systems, heat controls, and others, but proposes to issue these bulletins when completed in the form of a manual.

In addition to the bulletin publications, the committee also encouraged research in solid fuels and their burning equipment and collected, correlated and distributed the resulting information. It also aided in the organization of several local groups for cooperation among local members of related industries to secure understanding of common problems.

In the Anthracite Institute and its affiliated laboratory, the hard coal group has an organization which during the year has given special attention to the prime

interest of developing anthracite-burning equipment. Since the mining, cleaning and preparation processes with hard coal have been perfected, the burning equipment has come in for study, and the Institute awards its seal of approval to equipment which after study in the laboratory and the field is found worthy. The progress being made is shown not only by the fact that 40 devices were awarded the seal during 1932, but by the diversity of this equipment which ranged from delicate temperature controls to heavy duty stokers and mechanical draft appliances. Automatic stoking of all sizes of anthracite is within the scope of the approved equipment.

Two other activities of the institute should be mentioned although they are not applicable to the use of anthracite for heating. One is the development of an industrial gas-making machine for use on the premises of the customer whereby anthracite is used for gas-making for specialized processing in heat treating. The other is the successful experimental use of anthracite as a filter for filtering water in municipal water works.

The Gas Activities

The American Gas Association, which has often been referred to as a model of trade group organization, is the agency which looks after the problems arising in the use of gas, both as an industrial and a heating fuel. Activities directly relating to building heating with gas are within the scope of its House Heating Committee and its Committee on Industrial Gas Research.

One of the important projects of the association was the publication of a revision of its pamphlet on "House Heating with Gas."

Another interesting activity was the continuation of the attempts to develop usable methods of cooling with gas during the summer months. A field project was initiated in 1931 which contemplated the operation of silica gel cooling plants in three houses in order to gather data of value in a further study of the problem. Actually only two of these houses were placed in operation. This project was continued in 1932, and operating data were obtained from five houses. One of the houses, in which a conditioned cubage of 25,000 was present, showed an average operating cost of about 15 1/3 cents per hour during the warmest part of August. It is expected that additional data on this installation—which used a silica gel plant of new design —will be made available very soon.

Operating data on a large office building in Dallas, and a bank and office building in Baltimore, were also collected during the year.

A publication, "Developments in Air Conditioning," by a subcommittee on air conditioning also appeared during the year and illustrates the silica gel plant, and a steam cooling plant of recent design which uses gas as a fuel.

Another project of interest was the publication of a revision of the association pamphlet "Combustion," which summarizes much of the existing information on this important subject.

The laboratory maintained by this association continued to test appliances and to bestow its seal on those approved. During the year 446 space heaters and 391 boilers and furnaces received approval. The laboratory also continued its practice of carrying on fundamental research, and a pamphlet on elimination of noise in industrial burners was among those which were published during the year.

Plumbing and Heating Bureau

The fuel groups are by no means the only ones who have worked hard during a trying year, and we will now turn to an organization which is composed of manufacturers, wholesalers and contractors — the Plumbing and Heating Industries Bureau. In fulfilling its function of promoting the interests of these groups, the bureau serves as a forum for discussion of common problems. One of its important pieces of work during the year has been the preparation of articles which have appeared in newspapers and magazines throughout the country. The scope of this work can be judged when we learn that the bureau has succeeded in having its articles appear in publications whose combined circulation is in excess of 150,000,000. Much of the emphasis in this effort has been placed on modernization. It has also succeeded in causing a unit to be organized in the Department of Commerce which will serve as a clearing house for the statistical data available through the government departments.

The Warm Air Association

The National Warm Air Heating Association has to its credit a long period—fourteen years—of encouraging and financing the very well-known work on house-heating with warm air which has been carried on at Illinois. During 1932 it continued not only this work on gravity warm air, but added an investigation of forced air, and also started an investigation of summer cooling, using its research residence at Urbana for that purpose.

In September, the association published a code for the installation of mechanical warm-air furnace heating systems in residences, which was formulated by its code committee and the code committee of the furnace blower manufacturers. These rules were much needed and are proving generally popular.

The association's publicity work has been continued as well as its activities bearing on the commercial and production sides of the industry.

Unit Heaters and Fans

The Industrial Unit Heater Association devoted a large share of its attention to securing recognition of the code for testing and rating unit heaters which was developed in 1930 by a joint committee of the association and the A.S.H.V.E. Considerable success was attained in getting architects, engineers and purchasers to specify that industrial unit heaters must be rated according to code. A standard form of sticker was also adopted, and the members are using it on their products. The association has under consideration other engineering work arising in connection with the development of unit coolers and air conditioning units

which are closely allied with the present products, and are now being made by a number of the same group of manufacturers.

The National Association of Fan Manufacturers found it necessary to give careful study to cooperation in the matter of credit and has also considered thoroughly the new condition brought to the industry by the increasing interest shown by the public on the subject of air conditioning. It also adopted a sticker of striking design which it has been using in promoting acceptance of its code ratings.

Steel Heating Boilers

Work of the Steel Heating Boiler Institute during the year was largely technical. The usual effort to improve commercial and ethical features has also been carried on, but has had to be lessened by the general restriction of business activities. The outstanding accomplishment of the Institute during the year was the revision and adoption of its code for rating low pressure heating boilers, which occurred on November 19. The institute's rating code was originally adopted in 1929 and has since been widely accepted by the engineering and heating professions. Revision of the code to include formulas for determining furnace heights for stoker-fired boilers has added a great deal of value to it. Members of the institute feel that the revised code will be equally accepted, and that the accomplishment of this work has contributed substantially to the progress of the industry.

District Heating

Representing the utility companies who furnish utility steam and hot water and the manufacturers in this group, the National District Heating Association has watched over their united efforts for a long period. The past year saw no let-up in its activities.

The outstanding achievement of the association during the past year was the bringing out of its handbook and placing it before the public for distribution. This book is comprehensive and has received high acclaim.

Other activities include work along the line of meters, station operation and investigations into corrosion. The latter has been placed in the hands of the best men of the association to see what can be done toward avoiding corrosion in piping on customers' premises. There is a committee working on this problem and its publications during the past year have been of value.

Under the activities of the meter committee, the flow meter has been given the most attention, and from conclusions reached, improvements are needed in metering steam. The distribution of steam between plants and the customers is receiving a considerable amount of attention. Improvements are being made and losses are being reduced.

Electric Power

Since the electric loads resulting from oil burners and stokers have become sizable, and with air conditioning offering a promising field, the electric utilities have shown interest and are now planning wide expansion in the promotion of this business. The National Electric Light Association has become active. A report on "Marketing Electric Air Conditioning" recently appeared and followed shortly after one on "Selling Electric Ventilation." Committees are engaged in making sales studies of oil-burning equipment for home heating, home air conditioning, and for air conditioning in commercial and industrial establishments.

Ice

During 1931 the ice industry began to give really serious thought to the ice consumption possible if methods of cooling using ice were to come into wide use. The program of the National Association of Ice Industries included attention to this subject during 1932. Early in the year pamphlets were distributed to give information, while encouragement was lent to moves for gathering operating data during the year. Comfort cooling with ice occupied a prominent place in the program of the annual meeting.

Encouraged by the largest attendance in the last three years at its annual convention in Chicago early in November, the National Association of Practical Refrigerating Engineers decided to materially increase its educational activities, including the newer developments in comfort cooling, and to this end increased the personnel of its Educational Board. While its program in comfort cooling work thus lies more in the future rather than in the past year, this old established organization is moving actively to take part in comfort cooling.

Building Owners and Managers

Operating data and material collected by building owners have always been of interest to engineers and contractors as they show the results obtained from the plants designed by the engineers and installed by the contractors. The National Association of Building Owners and Managers has long assembled such material but only in recent years developed a form by which the essential items for a full heating record can be readily gathered. During 1932 the association continued to distribute copies of this daily record heating form. The association's publication, "Skyscraper Management," carried stories relative to heating, and fuel controls and records, and also described the various charts which the association has developed for heating and for fuel consumption.

In the association's annual Experience Exchange Report, analysis of operating costs for office buildings, a separate section was devoted to the costs of heating and ventilating. The buildings reporting for the 1931 report, totalling over 42,391,000 sq. ft. of office space, had an average heating cost of 7.5 cents per square foot.

Here, then, is a brief story of the accomplishments of these organizations in one short year when working under difficulties. It is not hard to understand why their activities are deemed worthy of support by those directly interested. They have done a worthwhile task well, and when put together their yearly record is impressive.

The Year's New Equipment

Summaries and Trends

A REVIEW would not be complete without paying attention to new equipment. While we have no data on which to base a comparison with former years, there is nothing to indicate that the number of items of new equipment has fallen off during 1932, in spite of the condition of general business. When it is borne in mind that new equipment is brought out by its makers because they fully expect the product to "take," we would expect new equipment to fall in closely with the buying trend of the public, and with technical developments as they come along.

In arriving at the number of items of new equipment, there are several sources to which to look. As reliable as any is the New Equipment section of HEATING AND VENTILATING, which during 1932 was made up of nearly 300 items. The following table has been prepared by arranging most of these items into five groups. After each group the total number of items appearing from January, 1932, to December, 1932, are listed, as is the number of these which were brought out by new firms.

	No. of Items	No. of New Firms
Boilers, Furnaces and Burners	33	11
Heating Equipment *including radiators and coils, enclosures, systems and accessories, pumps, water heaters, etc.*	44	10
Air Conditioning *including humidifiers, coolers, cabinets, basement units, fans, unit heaters and coolers, unit ventilators, etc.*	70	32
Instruments and Controls	56	6
Miscellaneous *including motors, insulation, pipe and pipe fastening, meters, tools and accessories.*	28	9

It is of interest to note that 68 of the items were placed on the market by manufacturers whose names are new to the heating and ventilating industry. Moreover, it is also interesting to note how the numbers of new manufacturers vary in the different subdivisions of the table. For instance, in the case of instruments and controls, only six of the items of equipment which appeared during the year were brought out by firms new to the industry, while in the case of the 70 air conditioning items listed, 32 were brought out by firms new to the industry. This shows clearly that much of the activity in new air conditioning products was due to firms entering the field, probably because it was so generally thought that equipment of this kind would find a ready market.

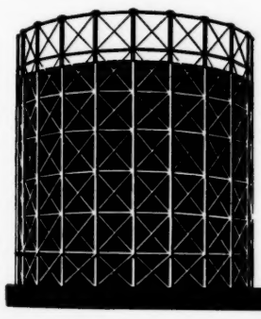
It is also of interest to note that of the five major groups, air conditioning devices constitute the greatest number. Instruments and controls are a good second, and the various items of heating equipment are in third place. Numerically, boilers, furnaces and burners are fourth and account for less than half as many of the new products as air conditioning.

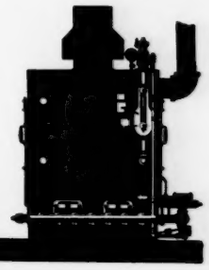
This is a decided change in trend, since for several years there has been great activity in the development of boilers, furnaces and burning devices to accommodate the several fuels. This would indicate that during 1932 there was more interest in, and probably more of a prospective market for, air conditioning devices than for burning devices. To some extent, too, it shows that air conditioning is now passing through the development stage when there is a great rush of equipment to the market. There is nothing surprising about this, for history shows that most similar movements pass through such a period.

While the figures are of interest in showing relatively the number of products which have been introduced on the market, they do not give any clear indication of the trends which the year has shown. Careful examination of the items which go to make up each group indicates that there are two trends of interest and importance. One is the notable change which is taking place in the boiler and burner group, while the other lies in the remarkably large number of air conditioning devices appearing. In order to get a more comprehensive view, it seems well to take up each of these groups separately and to outline the principal points.

Boilers, Furnaces and Burners

For some years there has been a notable tendency for heating boiler designs to abandon some of their traditional characteristics and to take more and more account of the burning characteristics of the fuel. Since the fuels burn so differently, there has been a continually increasing acknowledgment of the fact that it is desirable to have a boiler intended specifically for the fuel which it is to use. During 1932 it seems as if this tendency has been more marked than in former years, and as a result it is difficult to consider the late designs of heating boilers without also considering the fuels.





Because of this, we have grouped the two together.

In spite of this close tie-up some of the figures on boilers can be looked at separately to advantage.

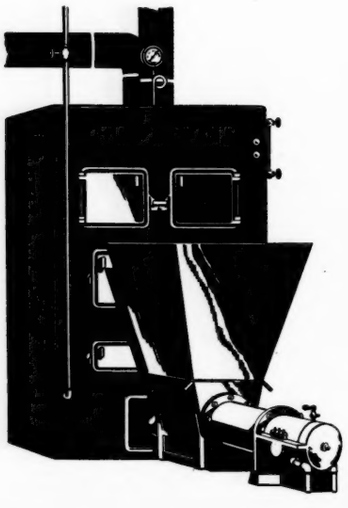
Fifteen boilers—or lines of boilers—were brought out during the year by as many manufacturers. Of these, five were announced in a line of sizes extending through residential and commercial to small industrial buildings, while 10 were of such sizes that their typical application would be in detached residences or buildings of similar size. Of the 15 designs which appeared, five manufacturers announced lines of cast-iron boilers, while 10 used steel as the material. This shows a decided preference for the use of steel. Whether or not any significance is to be attached to this is questionable when it is considered that the steel designs were very largely for adaptation to oil firing. With the increased use of welding, steel has some attractions, but it remains to be seen whether this predominance of steel designs can be said to show a permanent trend.

Some years ago, when the first boilers appeared with metal jackets enclosing the insulation, some people predicted that the day was not long distant when all heating boilers would carry this feature. Examination of the boilers announced during 1932 recalls this prediction and tends to emphasize it, for of the 15 designs announced, nearly every one includes a metal jacket over the boiler, and most of them come finished in bright and attractive colors. The movement toward improving the appearance of the heating unit can be said to be nearly complete, so far as the new designs can make it so. During the year, however, it cannot be said that any striking originality in the matter of exterior appearance has been brought about.

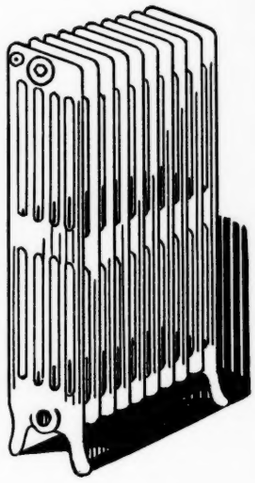
During the course of the year, at least three manufacturers entered the field with lines of boilers. One is a long-established jobbing and manufacturing house, another a prominent electrical manufacturer, and the third is a firm with an automotive background.

Still another tendency which may be noted from the figures for the year is that rectangular designs are tending to displace the round boiler. This is true despite the appearance of several new designs of round boilers.

A number of other interesting tendencies may be noted, but since they are concerned with fuel, we can now stop and notice how the year's boiler designs are related to the fuels.



Of the 15 boiler designs, four are distinctly for gas firing, seven are intended for oil firing, while the remaining four are for use either with coal or are readily convertible. Of these four, only two are definitely stated by their makers to be adaptable for firing by fuel other than coal. One of the others is stated to be intended principally for stoker firing, while the other is a combination boiler-stoker unit.



This large preponderance of oil- and gas-fired designs is perhaps the most striking feature of the boiler group during the year and shows clearly the tendency toward bringing out specialized designs for the special fuels. In several cases, these announcements come from manufacturers who have previously had coal-fired boilers on the market. Apparently, they have found enough of a demand for the specialized fuel boiler so that they feel justified in bringing out such lines.

We are now ready to take note of the relation between the fuels and the boiler design. Of the four new designs intended for use with gas as a fuel, only one uses steel as the material. The others are sectional and resemble very closely the older cast-iron boiler in general design, being adapted in detail to meet the requirements of gas burning.

It is in the oil-fired designs that much of the originality appears, for in this group there are several features which may be called innovations.

In the first place, three of the bolier designs are definitely intended for use with the particular burner, which is not only built integral with the boiler, but the boiler and burner are so arranged that it does not seem possible that any other burner except the one for which the boiler is designed could be used with it. These units are obviously aimed at quantity production, and the fact that this many have appeared in one year may be taken to mean that we may soon see more and more of this sort of thing. This thought gains significance when one considers that the cream of the conversion work in residential oil heating has been taken off. From now on, perhaps the oil burner will become increasingly an item of original equipment in the building. If so, why not design it for use in its own particular boiler? This seems to be the general thought back of these designs.

Another innovation is the fact that one manufacturer has announced a line consisting of one size only. Either this installation must be made in all buildings up to its maximum capacity, or else small buildings are ruled out of its market automatically. So far as known this is the first time this has happened. Heating boiler manufacturers have felt that they are obliged to make a great variety of sizes and shapes of boilers. If this newcomer to the field, who enters from a background of electrical manufacturing, finds that only one size is necessary, the older manufacturers will be interested to know it.

As the boilers are so closely related to the burning means, we will consider them here. There has not been great activity in either conversion gas burners or oil burners during the past year, so far as new products

go. Five conversion burners were announced, as well as five oil burners. In most cases these were improved designs or additions to lines to round them out. In the case of stokers, eight are listed. Among them, there is a tendency toward screw underfeed, and a combined pulverizer and feeder appeared.

Air Conditioning

It was but natural that many manufacturers would be attracted to the highly-publicized field of air conditioning, especially as many people were led to consider that its extended use—like prosperity—was just around the corner.

The activity of the year did not center around those products which have been standardized to a considerable extent through years of use, but ran in the direction of innovations. Thus, but few fans and unit ventilators were announced—in fact no new designs in fans and only one new schoolroom unit. Two gas-fired suspended type unit heaters appeared, as did several ceiling units intended for use during both summer and winter. A steam turbine-driven unit heater was announced during the latter part of the year. Only two manufacturers not previously represented entered products, and altogether we find the names of 12 manufacturers who either entered or announced new products.

Where the year's activities really were concentrated was in producing designs for air conditioning railroad cars, and for use in small building spaces. Both of those activities are related, for both are the result of attempts to promote the use of air conditioning in relatively small units of space. The small building spaces may be considered as made up of residences and commercial buildings.

In the case of the railroad cars the attempts have nearly all resolved themselves into the construction of light, compact units which can be installed readily in existing cars and still have enough capacity to carry the loads imposed. Recent announcements have shown units of this kind to such a degree that it appears that the designs are approaching standardization of arrangement. There is still plenty of variety in the refrigerants used. Of the four companies who announced new units for railroad cars during the year, one was already engaged in heating work, two were general railway equipment manufacturers, and one was a refrigeration machinery maker.

Attempts to extend activity in air conditioning to small, to medium-sized buildings, or units of building space, was what led to most of the new equipment during the year. In fact, we find 58 of these listed. In many cases they are factory-built units for use in conjunction with either steam or hot water heating, or with warm-air plants.

In warm air, seven old established company names are included in the list of those who have brought out conditioning units during the year. For the most part they have already had products in air conditioning, and their new equipments are improvements and redesigns. All are of the basement type. Rise to popularity of separate units to be added to warm-air plants is a notable trend in the announcements during the year.

Direct room units for use with steam or hot water plants have had a considerable vogue, and several firms have added cabinets of this kind to their line, as well as some notable newcomers, mainly from the electric refrigeration industry.

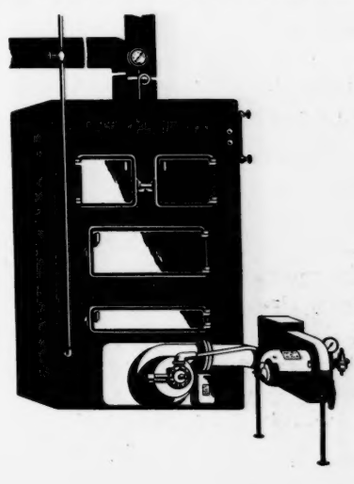
Humidifying equipment has been a favorite with manufacturers during the year. No less than 15 of these are listed. They are mainly of the direct cabinet type, although several basement units are included. In addition, numerous plans have been advanced for evaporating water by using the heat from the stack gases of warm-air plants.

Two new ozonizing equipments made their appearance.

The air cleaning function came in for considerable attention, and a number of non-spraying filtering units were announced. These were ingenious, not only mechanically, but the use of glass wool as a filtering substance was new. Improved methods of cleaning the filters included a removable fabric pad. A wool fabric filter of a new design and a corrugated woven-wire cloth unit were announced.

A movement toward the use of ice which began to gain headway during 1931 was carried over into 1932 and iced portable room coolers, and iced melting tank units appeared on the market as standard products. Mechanical compression units were adapted for use with room cabinets and with unit coolers of both the floor and ceiling types. These cabinets were frequently adapted for use during the heating season as well as during the summer. Nearly all the manufacturers of small-sized electrically-driven mechanical compressors brought out room cabinet units.

The steam jet, or ejector, method of extracting heat from water was applied to both residential units and to units of large size with the result that no less than four separate manufacturers announced products. Portable iced units, usually of 200-300 lb. capacity, with mechanical circulation of water over the ice and mechanical air circulation, appeared to the number of eight.



The year saw a number of controls and instruments brought out for air conditioning installations. The problems of humidity control received especial attention, with four manufacturers offering new or improved designs of humidistats, while two new recording hygrometers appeared. Notable developments in controls and instruments powered by both compressed air and electricity took place.

Heating Equipment

During recent years there has been much activity in developing radiator enclosures for straight heating systems. This past year there was comparatively little effort along this line as the air conditioning cabinets seemed to absorb all this effort. One manufacturer brought out a line of tubular cast-iron radiators. No marked changes in the design or appearance of direct cast-iron radiators were noted, although one maker introduced a new concealed cast-iron surface of distinctive design. Several cabinets in which fuel is burned directly in the room were introduced, and are notable because of the use of oil as fuel rather than because of the novelty of the idea. Altogether 12 new products are included in our list.

Many specialties and accessories appeared during the year. These included a line of bronze gate valves, four radiator valve lines, six inverted bucket traps, two air valves, and a float trap with thermostatic by-pass.

Pumps continued to occupy a prominent position in new equipment, eight of them being announced. All were by firms previously in the field and thus were either redesigns, or represented the addition of pumps to round out a line. Two vacuum pumps—one turbine-driven—a condensation pump, and several water-handling centrifugals were included.

Several new heating systems were announced. One is for steam heating, and features a trap which controls the venting of air from the radiators, and permits all mains to heat up before the return lines vent. Another, recommended by its maker for residences and greenhouses, raises steam and water to an elevated tank, causes the heated water to circulate through the radiators and back to the tank. A third uses gas as a fuel and circulates a mixture of combustion gas and steam to some of the heating surface. Several makers announced changes in accessories and controls for their present systems.

The increasing importance attached to control was reflected in the large number which continued to appear regularly throughout the year, there being no less than 44 such items, both new and improvements. In addition, 12 instruments to assist in operation are listed.

Besides the humidity instruments already mentioned under air conditioning, there were improvements and redesigns in nearly all kinds of thermostatic control devices, including relays, switches, valves, two-range thermostats and clock-operated thermostats. Pressure controllers, water and steam controls for use at the boiler, draft controls, and motor-operated valves, both electrical and compressed air, were included in the year's announcements.

A method of control of temperature which used several thermostat locations to get a mean control reading was announced as well. Another unusual arrangement consists of two electrical elements in a box placed on the cold wall of a room in order to get control.

It cannot be said that any noticeable trend toward the use of any control or instrument developed, nor that the field expanded with a rush of new manufacturers.

Miscellaneous

In piping, no new standards appeared, and since the materials and sizes are well established it is not surprising that there have been no new products of direct interest to us in the past 12 months. A new mill for the manufacture of wrought iron pipe by a continuous process was opened, however, and the appearance of wrought pipe from this mill may result in a shift in the relative positions occupied by wrought and steel pipe in heating work.

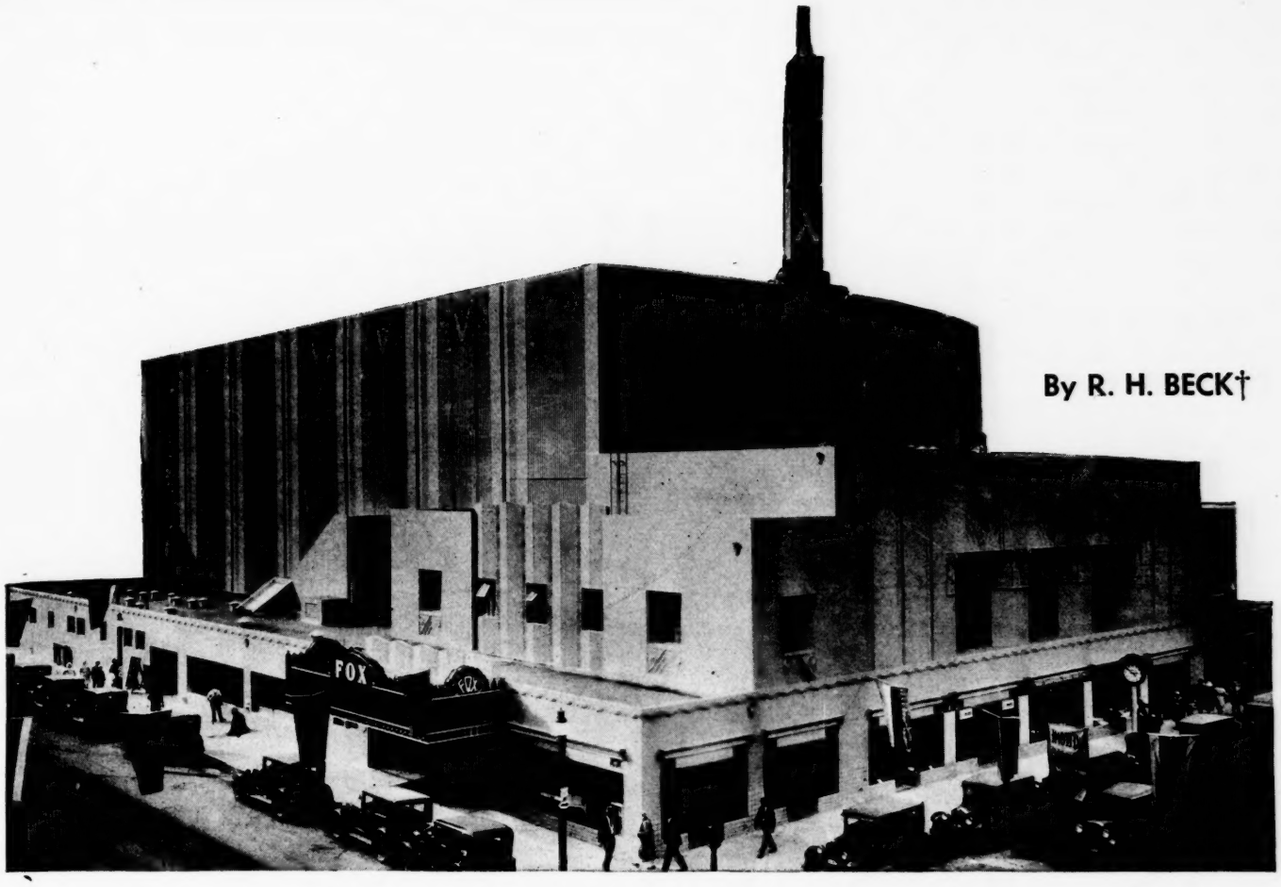
While threaded fastenings continued to occupy a prominent place, the use of welding increased. The year saw developments looking toward the wider use of welding for fastening when the methods of welding large cross-country gas pipe lines were extended to the smaller sizes. Inasmuch as those methods are confidently expected to lower both labor and material costs in welding, their appearance in the form of improved equipment and tools should not pass without due attention being given to it. The year also marked the appearance of a considerable number of shop, bench, and field tools for positioning pipe for welding.

Our lists show that but one manufacturer actually brought out a line of welding fittings during the year. Use of these factory-built fittings continued to grow, however, and their general availability has probably influenced the acceptance of pipe welding for heating to a greater extent than many realize.

Fractional horsepower motors especially adaptable to heating, ventilating and air conditioning continued to appear with nine old established makers having interesting announcements. One manufacturer undertook to overhaul and redesign virtually his entire line. As a result there are now available fractional horsepower motors with a great variety of characteristics.

In heat insulation several new products are of interest. Several forms of foil insulations for use with pipe appeared and reflect the growing appreciation of the possibilities of the use of foil to prevent heat flow. Something of the same tendency may be noted in building insulators where foils and thin sheets are being applied. A lead residue cement-form insulator, made its appearance, as did one in the form of a board fastened to sheet metal, as well as several building materials having insulating properties.

During the year, too, there appeared an expansion joint for steam lines which may be packed under pressure, and also one which uses a corrugated bellows. Other items of interest include a sleeve for inserting into the ends of pipe to thicken the wall under the threads and retard corrosion, a rotary condensation meter, a buckwheat blower, a duct expansion joint, a safety boiler feeder, a basement sprinkler system for residences, an induced draft fan, and a fan of special design for use in pneumatic dust collection.



By R. H. BECK†

The First Completely Air Conditioned Theater in Spokane

THE Fox Spokane Theater, located in Spokane, Wash., is the first theater to be completely air conditioned in that city. The owners, the Fox West Coast Company, recognized that air cooling and other air treatments were a necessity, due to public demand and the climatic conditions in that city. Accordingly, they decided to capitalize on the fact and instructed their architect, R. C. Reamer, of Seattle, to design the building so that the air cooling system was given proper advertising value.

Since Spokane is built upon almost solid rock, excavation for basements is a very expensive item in building construction. Therefore, the ideas of the owners to advertise the air cooling feature met with the architect's approval, as he was able to locate the entire machine and washer room above ground so that the air conditioning equipment could be seen from the sidewalk through large windows near the entrance. This design, consequently, accomplished two purposes: First, it eliminated the expensive basement excavation, and secondly, it enabled the theater owners effectively to advertise the only air-cooled theater in the city.

The theater is located in the main business district. It is of reinforced concrete, with a seating capacity of 2200 people. The theater proper is surrounded on three sides by stores rented as specialty shops. It is recognized as one of the most beautiful theaters on the Pacific coast.

The air conditioning plant is designed to maintain in the auditorium 80° dry bulb and not over 44% relative humidity when the outside dry bulb does not exceed 95° with a 75° wet bulb. These conditions are maintained when 2200 seats are occupied. A maximum of 13,200 c.f.m. outside is admitted for ventilation purposes.

Spokane enjoys a city water supply not met with in many localities. The maximum temperature of the water in the city mains during the summer months is 52°. Therefore, a compound air washer was installed, the first washer using the city water and the second washer using refrigerated water. For the purpose intended, this type of plant is very flexible, requiring minimum refrigerating effect throughout the year, and requiring a comparatively small refrigerating system as compared to a plant where the entire load is taken care of by refrigerated water.

Under the main auditorium are the concrete return ducts, which receive return air through mushrooms un-

†Manager, Seattle Branch, York Ice Machinery Corporation.

der the seats. The plenum chamber under the balcony is also used for return air, which enters through mushrooms in the balcony floor. Conditioned air is supplied through a galvanized duct system, the area under the balcony receiving the conditioned air through ducts, which are in the balcony plenum.

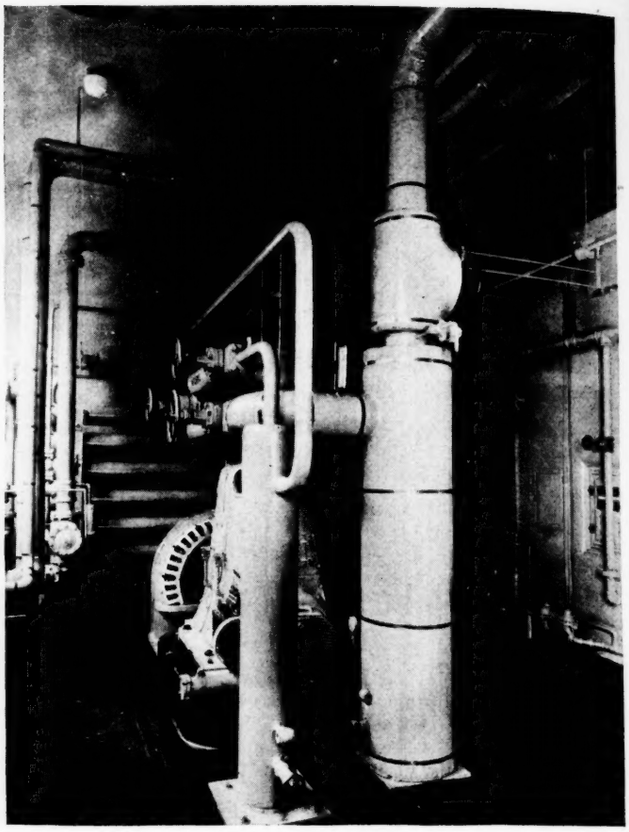
Conditioned air enters through the ceiling of the auditorium by means of a duct system in the space above the ceiling proper. The foyer is also air conditioned.

The conditioned air duct system is designed so that vibration is eliminated. Connections between the duct systems and fans are of canvas to prevent carrying of noise into the auditorium. The ducts are insulated with mineral wool blanket, ½ in. thick, applied to the metal with sodium silicate and metal bands. Sound traps are installed in the discharge of the main supply fan and in the return duct to the dehumidifier.

There are 470 8-in. adjustable mushrooms in the main auditorium floor, and 236 mushrooms of the same type in the balcony floor.

Ducts for fresh air, recirculated air, and bypassed air are provided, the fresh air inlet duct being taken from the roof directly above the washer room through louvered intakes. The recirculated air duct and bypassed air duct are built of concrete under the washer.

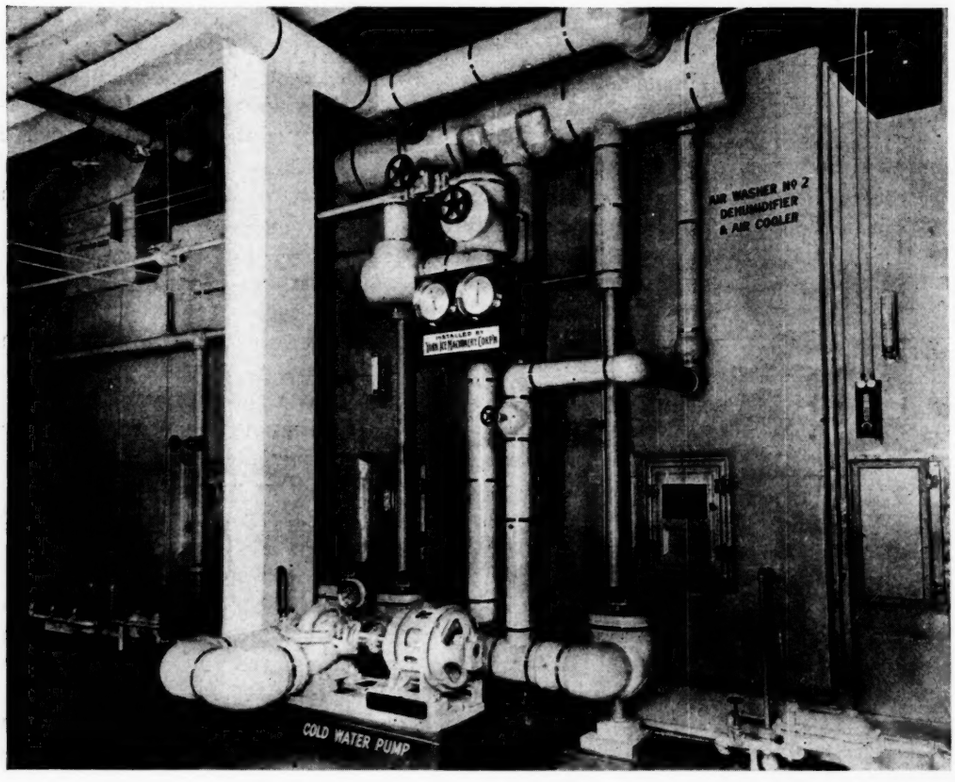
An exhaust system is provided for the projection room and a separate exhaust system for the rest rooms. These rooms are provided with conditioned air, the exhaust fans taking the air from these rooms and delivering it direct to the outside atmosphere. The capacity of these fans is less than the amount of air supplied for ventilation purposes, thus keeping the theater under a slight pressure, so that vestibule doors exhaust the excess air. Infiltration is kept at a minimum on account of the dust which prevails at some times of the year.



The mechanical refrigerating apparatus occupies but little floor space

Equipment

Included in the equipment is a compound air washer, consisting of a washer using 52° city water and a washer using refrigerated water. The washer is complete with inlet deflectors, eliminators between the first and second stages of the washer, and eliminators for the second stage of the washer. The first stage contains the spray nozzles using city water, and the second stage contains the spray nozzles using refrigerated water, and also two banks of carbon dioxide evaporator coils, arranged so that the sprays impinge the water on the coils. Both the first and second stages are insulated with 2 in. of corkboard, having a cement plaster finish, painted in accordance with the balance of the equipment in the machine room. The washer has an air capacity of 45,000 c.f.m.



Central conditioner and water pumping equipment

The fan has a capacity of 66,000 c.f.m. of air and is driven by a 30-hp. variable speed motor.

Refrigerating Equipment

The compressor is a 5½ in. x 6 in. carbon dioxide, two-cylinder vertical type, direct-connected to a 100-hp. synchronous motor, having flywheel effect in rotor. A carbon dioxide condenser, consisting of six 8-in. shells, each with tubes, and a 16-ft. shell, is installed. There are two sets of galvanized, extra heavy, 1¼-in. evaporator coils for use with carbon dioxide. These coils are of the low resistance type, adaptable for operation on the flooded, recirculating principle.

Inasmuch as the cooling equipment can be viewed from the windows on the sidewalk, it was thought advantageous to name the various pieces of equipment so that passers-by could get some idea of what equipment was installed and to further enhance the advertising value of this plant.

Steam Heating Equipment

The steam heating equipment was designed to produce a dry bulb temperature of 72° with an outside air temperature of 15°. Heating coils are provided in the air washer for tempering the incoming air and for heating the conditioned air. The heating system is provided with diaphragm steam valves operated by air pressure through thermostats.

The stores surrounding the three sides of the theater are not furnished with conditioned air from the central system, but are heated with standard cast-iron radiators.

Steam under 5-lb. pressure is supplied to this theater from the central heating system, eliminating the investment in boilers and auxiliary apparatus.

Detroit Utility Investigates Air Conditioning Costs and Methods

COMFORT cooling equipment installed in commercial offices of the Detroit Edison Company last summer, in line with its promotional work on air conditioning, has enabled the utility to obtain cost and operating data on this apparatus.

An installation in the company's Farmer Street office in downtown Detroit cooled 57,000 cu. ft. of space, occupied 9 hr. daily, by means of cold water from an ice tank circulated through fin-tube coils in the air duct. Ice consumption for July, with an average outside temperature of 72.8° was 119.6 tons, and during August, with an average temperature of 73°, 116.2 tons were melted. The maximum cooling load was 20.7 tons, and the maximum consumption for one day was five tons. The lighting load for the system was 18.3 kw., and the installation cost $6100.

A similar system was installed to cool 100,000 cu. ft. of space in the Port Huron office. In this case the cooling load was 17.9 tons of refrigeration, and the lighting load was 8.5 kw. The apparatus was operated daily from 8 a.m. to 5 p.m. and used 80 tons of ice during July, and 89 tons during August. Fan and pump motors used 30 kw-hr. per day. The system cost $5700 installed.

An office of the company in the General Motors Building, Detroit, is cooled by eight direct cabinet coolers served by three 3-hp. compressors. The highest 1-hr. peak demand for the summer was reported as 7 kw., and the power consumption for the season was as follows: May 10-July 15, 1360 kw-hr.; July 16-August 16, 1240 kw-hr.; August 17-September 1, 760 kw-hr.; September 2-September 15, 160 kw-hr., giving a total of 3520 kw-hr. The system cost $4000.

In the company's Ann Arbor office a 17-ton compressor driven by a 25-hp. motor is used to cool a tank of water which is circulated through fin-tube coils in the air duct. The tank holds 17,000 lb. of water, and a thermostat in the tank starts and stops the compressor to keep the water within the temperature limits of 35° and 40°. The estimated power consumption of the compressor, pump, agitator, and fan is 106 kw-hr. per day. This installation cost $10,800. A system of the same type as the first two described is being installed in the Birmingham, Mich., office of the company, for which no data are yet available.

Residence cooling was also studied during the past summer through an ice installation in a Birmingham home. A space of 17,000 cu. ft. was cooled by ice water pumped through a cooling surface installed in the duct of a forced circulation warm-air heating system. The ice tank consisted of a 500-gal. fuel oil tank underground outside the house. The maximum cooling load was four tons of refrigeration. Cold city water was circulated in the cooling surface during June. During this month the system was in operation seven days, and the equivalent ice consumption would have been two tons. Seven tons of ice were melted in the tank during July and August, for which period the system was in operation 15 days. The maximum amount of ice used during one day was 2500 lb. on a day when the outside temperature went to 95° and the indoor temperature was maintained at 76° for 24 hr. This test showed the possibilities of the system, but did not represent usual operating conditions. In ordinary operation, the inside temperature would not be held so low and, therefore, the ice consumption would be less. The cooling equipment cost $800.

A steam ejector system in a Detroit restaurant cooled 30,000 cu. ft. of space during the month of August with a total steam consumption of 172,000 lb. at a pressure of 30 lb. per sq. in. With an outside temperature of 93°, a maximum indoor temperature of 81° was achieved with the unit running continuously from 6:15 a.m. to 9:30 p.m., during which period 6945 lb. of steam were consumed. The motor-driven water pump used 24.7 kw-hr. of power, and 4930 cu. ft. of condensing

water was required during the 15¼ hr. of the above test, for which the steam, power, and water charges totaled $5.49.

Some study was also made of the use of fans in residential cooling. It was pointed out that if cool outdoor air can be introduced into the house during the evening, a very appreciable degree of comfort can be achieved. Accordingly, in one home a multiblade fan driven by a ½-hp. motor was installed in the attic, and connected by ducts to grille openings in the ceilings of the second floor bedrooms. Air is drawn from the living quarters and discharged through openings in the attic, and the house is cooled by operating the fan with the windows open at any time when the outside temperature is lower than the inside temperature. Some degree of regulation can be obtained by opening certain windows and leaving others closed. The cost of the installation was $260. In another similar installation, a propeller-type fan, driven by a 1/6-hp. motor, was installed at the top of the attic stairs and discharged air drawn up from the first and second floors into the attic. This apparatus cost $152.75, and was reported as being successful.—*S. S. Sanford, before the Great Lakes Division, N.E. L.A.*

The Effect of Retrenchment on Housing and Office Space

WITH the cumulative effects of the past three years of depression, there has developed a state of mind concerning building which has been far-reaching in its unsettling effect. Talk to any contractor, builder, investor, professional man, or layman, and you will receive a chorus to the effect that new buildings will not appear for a long, long time. There are too many homes hanging over the market. There is too much office space available, even in the finest buildings.

The natural sequel to such an attitude is that business in general—so much of which depends on construction—is destined for a very long wait before it can expect any sort of a pick-up. This "licked before you start" reasoning is bound to deepen the gloom in which we find ourselves; furthermore, it militates against that basic, more sober type of reasoning which is not only so conspicuous by its absence, but is so necessary for the laying of that foundation upon which we hope to erect a stable regime.

By way of mental exercise and relaxation, let us take a deep breath and see what kind of a picture presents itself in response to our efforts.

In the outlying districts of our cities there are many "For Sale" and "For Rent" signs—a definite indication that there are more than enough houses to go around. Yet, real estate men tell us that the distress house situation has cleared up. Why then are so many vacant? The answer is largely to be found in the recent so-called "doubling-up" movement of families. The young man with a family, living in a nice home, gets a salary cut. A few months later comes another one. He becomes not only discouraged, but (and this is important) he gets scared. In many cases this young man can still scrape by, but with the constant fear of another slash in his salary, or possibly the final loss of his job, he takes his wife to one side to talk the situation over. The resultant feeling is "If we could rent or sell this house, we could live with mother till this whole business blows over." Two weeks later finds the young man living with his family, and his wife and junior are staying at hers. One more sign is added to the growing list.

Is this situation a permanent one? It is decidedly not. Two families never could lead a happy existence under one roof, and they are not going to begin now. Just as soon as our young couple can see a ray of hope in general conditions, they are going right back to their own home.

We said that our young couple had a child. This brings in another important factor, namely our ever-increasing population. Couple with this the fact that there is a never-ending rate of home obsolescence, and we find yet another strong factor for our picture.

Now let us look at the cities. With somewhat the same mental process which motivated our young couple, we find many an office manager receiving instructions to cut down. In many cases offices are discontinued, and all clerical work is taken to the factory—for we suppose there is plenty of space available there. In similar instances, the amount of office space is reduced. Frequently, those having offices in the better buildings, give up their high rent quarters and move to second- or third-rate structures.

Our answer to this situation is along the same lines as in the case of our homes. Just as soon as that ray of hope appears on the horizon there is going to be a real shifting of offices. It will not be long before the comparatively small amount of modern office space available will be all taken up. The second- and third-rate buildings will no longer appear so attractive to prospective tenants. The factories will soon manifest their eagerness to reopen city offices, and the movement will be well under way.

Already we can find numerous instances where old buildings have been or are being torn down. It is cheaper to pay taxes on the land when no building is standing on it. Meanwhile, that land pays well as parking space for automobiles. And right there we have a real potential building program which in effect will substitute modern rentable offices for obsolete, undesirable and unhealthy loft space.

Well, our picture doesn't look so terribly bad after all. And in painting it we have learned a few things. Above all we have learned that we need not become too discouraged. For those of us who have real merchandise and service to sell, it will mean some good hard plugging, but the writer cannot recall a time when that ever did anyone any harm.—*Philip K. Brown, Bon-Air Radiator Corporation.*

Advantages of Welded Piping in Home Heating Systems†

By FRED J. MAEURER

To change a present method of manufacture, construction or fabrication to that of another method, the reasons for such change must be based on sound, proven fundamentals, agreeable and beneficial to all involved, or no change should be made.

In developing reasons for changing the present method of pipe fabrication in heating installations in the homes, which at present is by threaded fittings and threaded pipe, to the more modern method of oxyacetylene welding and cutting, it has been found and proven that sound fundamentals for this change do exist.

In submitting reasons for suggesting a change, we feel that they must be such that the benefits resulting will be advantageous to every one or group connected with the (1) planning, (2) putting of the plans into effect, and (3) the ultimate user of finished product.

In a piping installation the above three groups would be (1) the man who plans the installation so that he is assured that it is correct in every detail, will operate efficiently and economically, and is best for his client; (2) the heating contractor, who must be assured that the piping installation will be better than the previous method used, that he isn't penalized with additional costs, and that it operates efficiently and economically; and (3) the ultimate user or owner, who must be assured that his piping installation will be enduring, have small maintenance cost, have minimum friction losses, and that he can deliver steam within the pipe to its objective at the least possible cost,—in other words that he will use the least amount of fuel to operate it efficiently and economically.

Now it is possible, with welding, to give each one of these three groups an easily planned, readily fabricated, efficient piping installation, and that was not possible before the advent of the oxyacetylene welding and cutting processes, which, on top of it all, bring to each group economies that are not possible with the old method of threaded fittings and threaded pipe.

For the designer, welded pipe now brings true his dream of smooth interior of pipe throughout the entire piping installation, long sweep bends, less heat losses, smaller pipe sizes, less weight, flexibility, ease of changes without affecting plans and the best possible installation for his client. These advantages were not open or possible for him heretofore. The advantages of long sweep bends are very important at this particular time because they are being heavily stressed on piping of larger sizes, particularly on power piping installations.

To the heating contractor the welding of smaller pipe sizes in home piping installations offers very definite economies not available with the older method of threaded fittings and threaded pipe. With the welding of pipe he finds economies in labor cost, material costs, insulation costs, and, what is far more important, a better and more enduring piping installation for the owner of the home.

To the owner or ultimate user there comes for the first time the possession of a heating installation that meets with his demands, and he soon finds that a welded piping installation offers very definite economies for him not before possible.

With smooth interior and exterior of his welded piping and long sweep bends he finds that his friction losses are reduced to a minimum, that the magnesia insulation can be perfectly fitted on the smooth outside of welded pipe, that he eliminates costly heat losses, that he can carry a boiler temperature of from 5° to 15° lower than is necessary with threaded fittings and threaded pipe, and that he is delivering the steam within the pipe to its objective at the least possible cost. All of this means to him lower fuel bills. He has a permanent piping installation with least possible number of joints, and one whose maintenance costs are reduced to a minimum.

So in suggesting a change in this particular piping fabrication we have endeavored to show that there are ample reasons as to why the change should be made and to indicate some of the benefits that will accrue to all interested —meaning architect, contractor, and home-owner—that will guide them in promoting this change in heating and piping practice.

Figs. 1. and 2 show the ma-

MATERIAL LIST

NO REQD	DESCRIPTION	COST
5	LIN FT 2½" STANDARD BLACK IRON PIPE	
120	" 2"	
210	" 1¼"	$ 55 28
110	" 1"	
110	" ¾"	
3	2½" - 90° C I ELL	
17	2" "	
32	1½" "	
30	1" "	
30	¾" "	
4	1¼" - 45° "	
9	1" "	
5	¾" "	
3	1¼" TO 1" - 90° C I REDUCING ELL	
4	1" - ¾" "	
1	2½" X 2½" X 2½" STD C I TEE	
1	2" X 2" X 2" "	
7	1¼" X 1¼" X 1¼" "	
2	1" X 1" X 1" "	
2	¾" X ¾" X ¾" "	
2	2½" X 2½" X 2" " REDUCING TEE	36 15
3	2" X 2" X 1¼" "	
9	2" X 2" X 1" "	
6	1¼" X 1¼" X 1" "	
5	1¼" X 1¼" X ¾" "	
1	1" X 1" X ¾" "	
2	2" TO 1¼" M I REDUCER	
6	1¼" M I PIPE CAPS	
6	2" X 6" BLACK WROUGHT NIPPLE	
10	1¼" X 6" "	
6	1¼" X 3" "	
19	1" X 6" "	
11	¾" X 6" "	
2	2½" CL "	
4	1¼" " "	
1	CAN RED LEAD	85
	85% MAGNESIA INSULATION	243 24
	TOTAL	$335 52

THREADED

Fig. 1. Material costs for a typical threaded heating system

†Abstracted from a paper presented at the 33rd annual meeting, International Acetylene Association.

MATERIAL LIST		
NO REQD	DESCRIPTION	COST
5	LIN FT 2½" STANDARD BLACK IRON PIPE	
120	" " 2" " " " "	
210	" " 1¼" " " " "	$53.65
110	" " 1" " " " "	
110	" " ¾" " " " "	
4	2½" 90° WELDING ELL	
2	2" 90° " "	9.38
1	2½" TO 2" " REDUCER	
6	1¼" M.I. PIPE CAPS. SCREWED	
	ACETYLENE, OXYGEN & WELDING ROD	9.60
	85% MAGNESIA INSULATION	228.43
	TOTAL	$301.06

PLAIN ENDS

Fig. 2. Material costs for a typical welded heating system

terial costs for a typical threaded and welded home heating system. The job as figured was for the same layout. Labor costs are not included. In the welded system, thirteen long sweep bends were used, either by bending them on the job or in the shop.

The total material cost savings for the welded long sweep bend installation is 10.3%, but this does not by any means represent the total savings possible because there is a very substantial saving to be had in the labor necessary for this and similar types of welded pipe installations.

This bending is not only possible, but is practicable. In the smaller size pipe, bending can be done cold, and in larger size pipe it can be quickly heated by the oxy-acetylene flame and then slowly bent to desired angle. In the smaller size pipe, bending can be readily accomplished by inserting smaller pipe in a pipe of larger diameter, then bent to desired angle, and in the larger size pipe a pipe vise can be used to hold pipe while heating and bending is taking place.

It is highly probable, and we make the prediction that in the not far distant future, piping installations will be entirely fabricated in the shop, taken to job and assembled along the same lines as followed in bridge construction and other types of fabrication.

In a piping installation in small homes where smaller pipe sizes are used, it is necessary to do a great amount of cutting and threading to complete fabrication, and all this cutting and threading means a threaded fitting of some kind must be used to continue the line of pipe. Following along this line of thought, it becomes obvious that the greater the number of threaded fittings used in fabrication, the greater the amount of friction set up, and the greater the amount of fuel which must be used to bring steam within the pipe to its objective.

To pursue this line of thought further, it naturally becomes obvious that in a pipe installation with the least amount of obstruction in its fabrication, the smaller number of short radius bends, and the greater number of long sweep bends, such as is obtained by bending long lengths, the least amount of fuel is consumed to deliver steam within the pipe to its objective. We are assuming the same size pipe is being used in both installations.

Now, we have stressed friction losses, because they are important, and because friction loss in small pipe sizes has not been given the attention it warrants. Previously, nothing could be done about it outside of using larger pipe sizes to compensate the losses due to sharp bends and fittings as there was no other way of joining pipe together than by using the same old threaded fittings and threaded pipe. The advent of oxyacetylene welding and cutting has very definitely changed this view and practice, because with welded piping and long sweep bends in an installation it has been definitely proven that it was not necessary to increase pipe sizes to overcome friction losses, but that pipe sizes could be reduced.

To fully illustrate the friction losses that are set up in an all threaded fitting and threaded piping installation and to clearly show what we have said about the smooth interior and exterior of welded joints and long sweep bends that reduce friction losses, Fig. 3 shows one important section of piping that leads from the supply line to radiator.

The top section shows three views of a threaded fitting and threaded pipe fabrication that very clearly shows the short angle bends and the roughness on inside of pipe at the joint. The lower section shows the same three views of the same fabrication that is welded, with long sweep bends used as described above, and it can be readily noted that there is nothing to retard the progress of steam to radiator. In the illustration, threaded pipe views shown at the top, it is noted that four threaded fittings are necessary to complete the pipe run from main to radiator, while with those that are welded, only two joints are necessary, the weld on the riser and one pipe weld, as shown.

Because of the importance of insulation to a heating installation, blueprints of the layout were submitted to a large national company which specializes in insula-

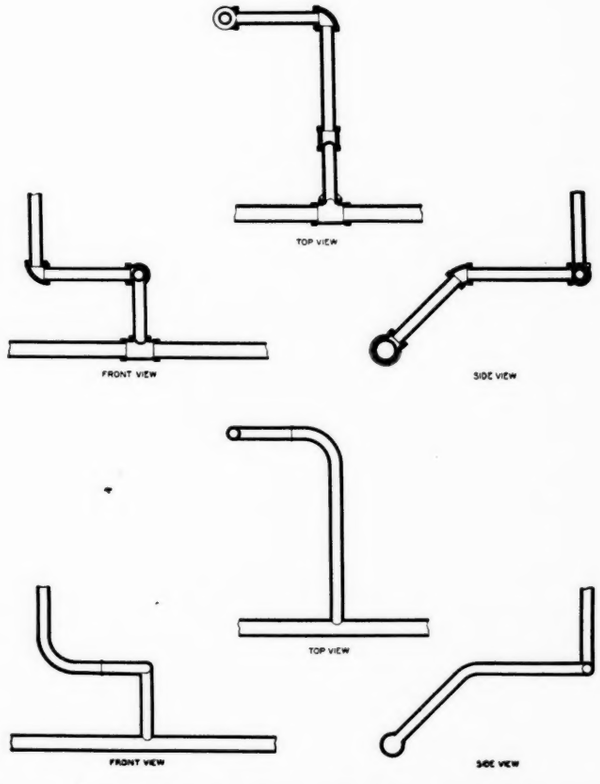


Fig. 3. Comparison of portion of piping, showing lessened resistance to flow in welded connections

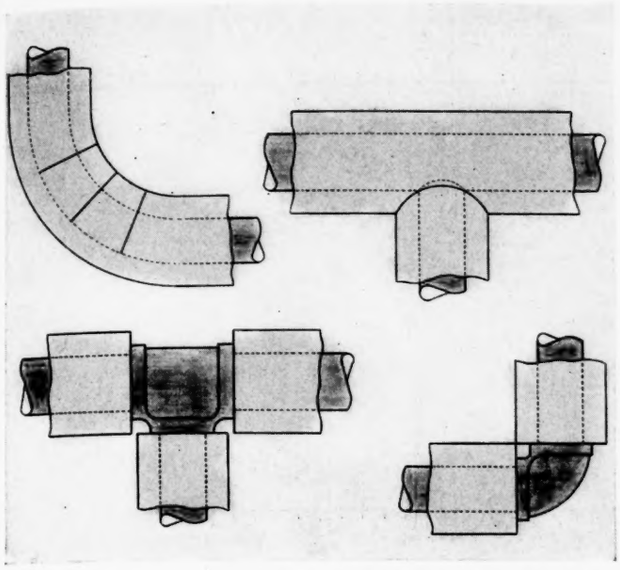


Fig. 4. Relative simplicity of pipe covering with the two types of joints

tion materials, for bids on cost of insulation material.

Their heating engineers recommend that an 85% magnesia material be used, and quoted a figure of $243.24 for material cost of 499 ft. of straight insulation, and 178 fitting joints for the threaded fittings and threaded pipe fabrication. They quoted $228.43 for 501 ft. of straight insulation and 138 fitting joints for the welded long sweep bend fabrication.

While the estimate for insulating the welded long sweep bend fabrication was $14.81 lower than the estimate for the threaded fitting, threaded pipe fabrication, this does not show the entire saving that can be had because the cost of labor is not included.

Fig. 4 clearly indicates where the real saving is made. On the threaded fitting, threaded pipe fabrication, there are 178 joints that make it necessary to stop straight insulation forms at threaded fitting. In the case of an elbow, straight forms stop on both sides and the threaded elbow is then covered by plastic insulation and moulded to same size as straight forms and then covered. In the case of a threaded tee and threaded pipe, straight insulation is brought up to the three sides of tee and plastic insulation is moulded to same size of straight forms and covered. This moulding operation consumes much time that does not show in estimate of insulation costs but must be taken into consideration.

On the welded, long sweep bend fabrication it was estimated that there were only 138 joints that required plastic insulation operations and then only on the pipe bends of the smallest size pipe, and that 50% of these joints could be efficiently insulated by cutting out sections from sides of straight forms, then drawn up, cemented and covered as also shown on Fig. 4.

On all welded connections requiring a tee, straight forms can be exclusively used, eliminating plastic insulation by cutting a hole in top of one straight form and cutting the end of another straight form to fit. (Also shown on Fig. 4.). All these insulation savings are only possible on piping installations of oxyacetylene welding and cutting fabrication.

Much research work has been done on welded pipe fabrication for the heating contractor. Specifications and qualification tests have been developed by responsible engineers and the national association, and vocational schools in every section of the country have installed pipe welding classes for plumbers and steamfitters, where the fundamentals of welding can be correctly and economically learned. Technical papers on pipe fabrication have been written and published, and large national threaded fitting companies and other large piping companies now have on the market welding fittings for welded pipe fabrication that meet any type of joint or change of direction of pipe that is necessary to be made, and all this means that the heating contractor who still fights shy of welding certainly is not taking advantage of the possibilities before him.

Correcting Radiator Sizes for Off-Standard Conditions

RADIATION requirements for buildings may readily be computed with the aid of either of the accompanying charts if any three of the four factors involved in radiation calculations be known. The charts are both designed to determine the heat emission with varying radiator and room temperatures, and not for determination of the heat loss.

Fig. 1 is a chart designed by J. N. Arnold, instructor in engineering drawing, Purdue University. To illustrate its use, assume the room temperature to be 65° F., the temperature of the steam 210°, and the heat loss as 96,000 B.t.u. per hour. The necessary equivalent radiation is determined as follows:

Through the 65° point and the 210° point on the room temperature, T_r, and the steam temperature, T_s, axes, respectively, a straight line is extended to intersect the Q axis. From this point of intersection, a straight line is extended to the 96,000 B.t.u. point on the A scale of the H axis. The result, 400 sq. ft. of steam radiators, is then read directly on the A scale of the S axis at the point where it is intersected by this line. A and B scales on both the H and the S axes are in similar units, but permit a closer reading of the quantities through two ranges of magnitude, and care must be taken to read H and S both on the A scales or both on the B scales. It should also be noted that had H in the foregoing example been 960,000 B.t.u. rather than 96,000 B.t.u., the value of S would have been 10 times 400 sq. ft. or 4000 sq. ft. The chart is therefore applicable for any range of values of H and S if the decimal point be correspondingly shifted.

Simpler and more compact, although perhaps not so flexible, is the chart reproduced in Fig. 2, designed by Louis Culkin, Brooklyn, N. Y. In this chart, required

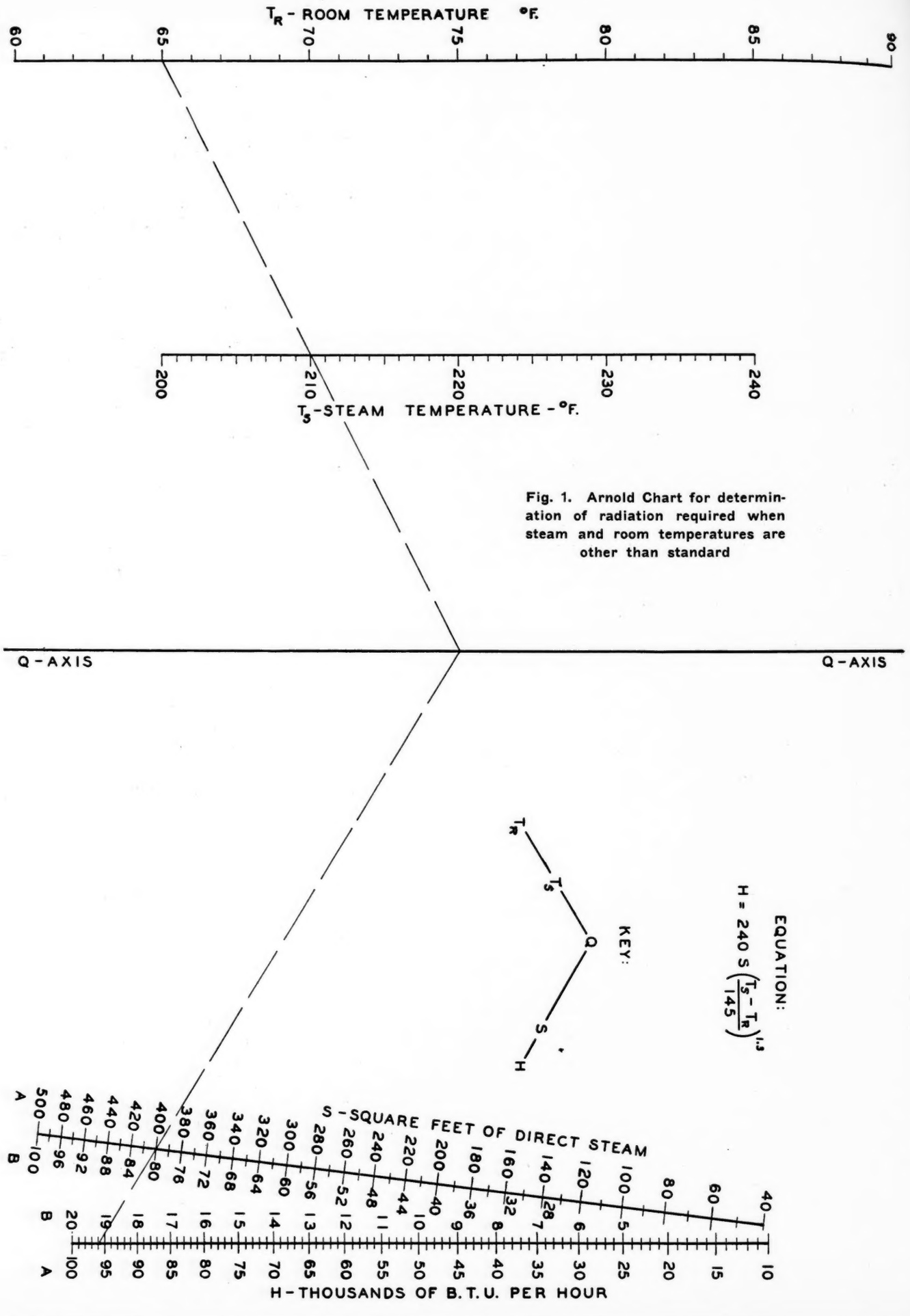


Fig. 1. Arnold Chart for determination of radiation required when steam and room temperatures are other than standard

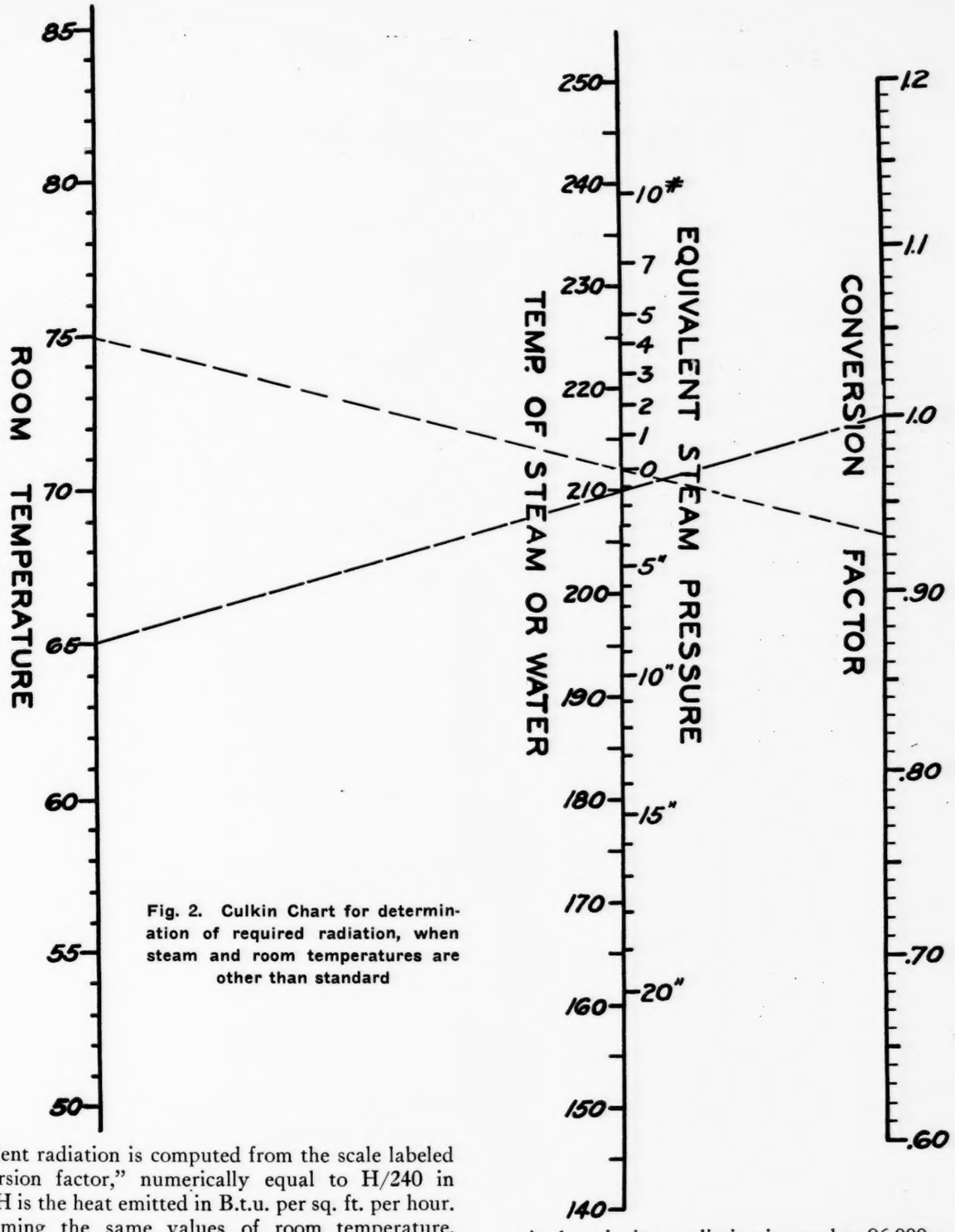


Fig. 2. Culkin Chart for determination of required radiation, when steam and room temperatures are other than standard

equivalent radiation is computed from the scale labeled "conversion factor," numerically equal to H/240 in which H is the heat emitted in B.t.u. per sq. ft. per hour.

Assuming the same values of room temperature, steam temperature, and heat to be supplied as were used in the previous illustration, the value of the conversion factor is determined by extending a straight line through the corresponding points on the T_r and the T_s axes until it intersects the axis designated "conversion factor." For the conditions named H/240 = 1.0, and therefore H = 240 B.t.u. per sq. ft. per hour. Dividing 96,000 B.t.u. by 240 B.t.u. the required radiation is found to be 400 sq. ft.

Another example illustrates the procedure when the condition of the steam is specified by naming the pressure. For a room temperature of 75° and steam at atmospheric pressure, the conversion factor is found to be 0.93 = H/240. Therefore, H = 223 and the required equivalent radiation is equal to 96,000 ÷ 223 = 430 sq. ft.

Both charts are based on the accepted formula:

$$H = 240\,S\left(\frac{T_s - T_r}{215 - 70}\right)^{1.3},$$

in which H = B.t.u. emitted per hour
S = equivalent radiation in square feet
T_s = temperature of steam in degrees F.
T_r = temperature of the room in degrees F.

In constructing the chart in Fig. 2 the above expression was assumed in the form:

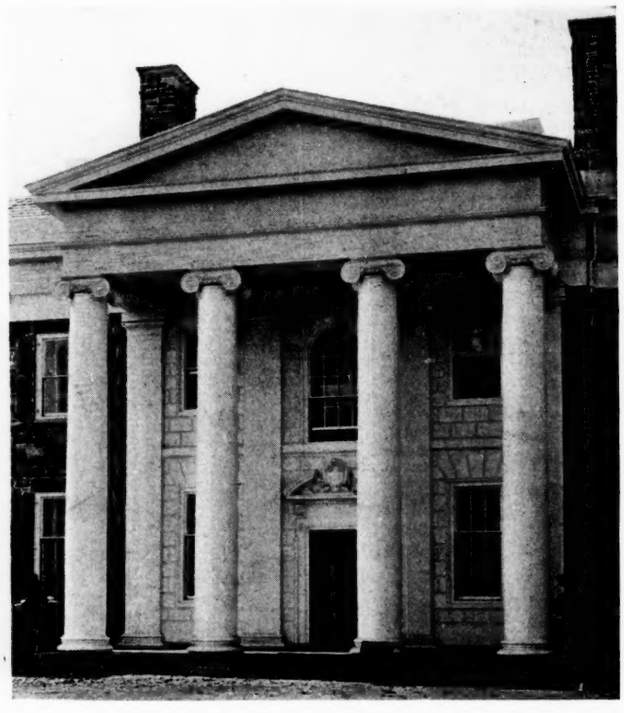
$$\left(\frac{T_s - T_r}{215 - 70}\right) = \frac{H}{240}$$

Heating and Air Conditioning a New England Mansion

By C. EUGENE CENTER

SOME of the latest developments in the field of residential heating and air conditioning, as well as several innovations in the application of standard commercial equipment, are to be found in the magnificent new home of Mrs. Mary Weld Pingree, recently completed at South Hamilton, Mass.

Heating specifications required that sufficient capacity be provided to maintain temperature and humidity within close limits the year 'round with full automatic control. This was to be done so far as possible without visible heating equipment in the main rooms of the house, and with complete absence of noise.



Forced circulation hot water was selected as the heating medium as its use offered several advantages in the elimination of trenches, low returns, boiler excavations, and quietness of operation. Economy is achieved through flexibility of the system, which provides automatic control of water temperatures in accordance with outside temperatures.

Three distinct methods are employed in distributing heat to various sections of the house. Cast-iron radiation with direct force-circulated hot water heats the servants' quarters, children's playroom, all bathrooms, and garage. Warmed and humidified air from two apparatus rooms in the basement is delivered through ducts to the master's rooms. Warmed fresh air is circulated through the lounge, gallery, and bowling alley sections in the basement.

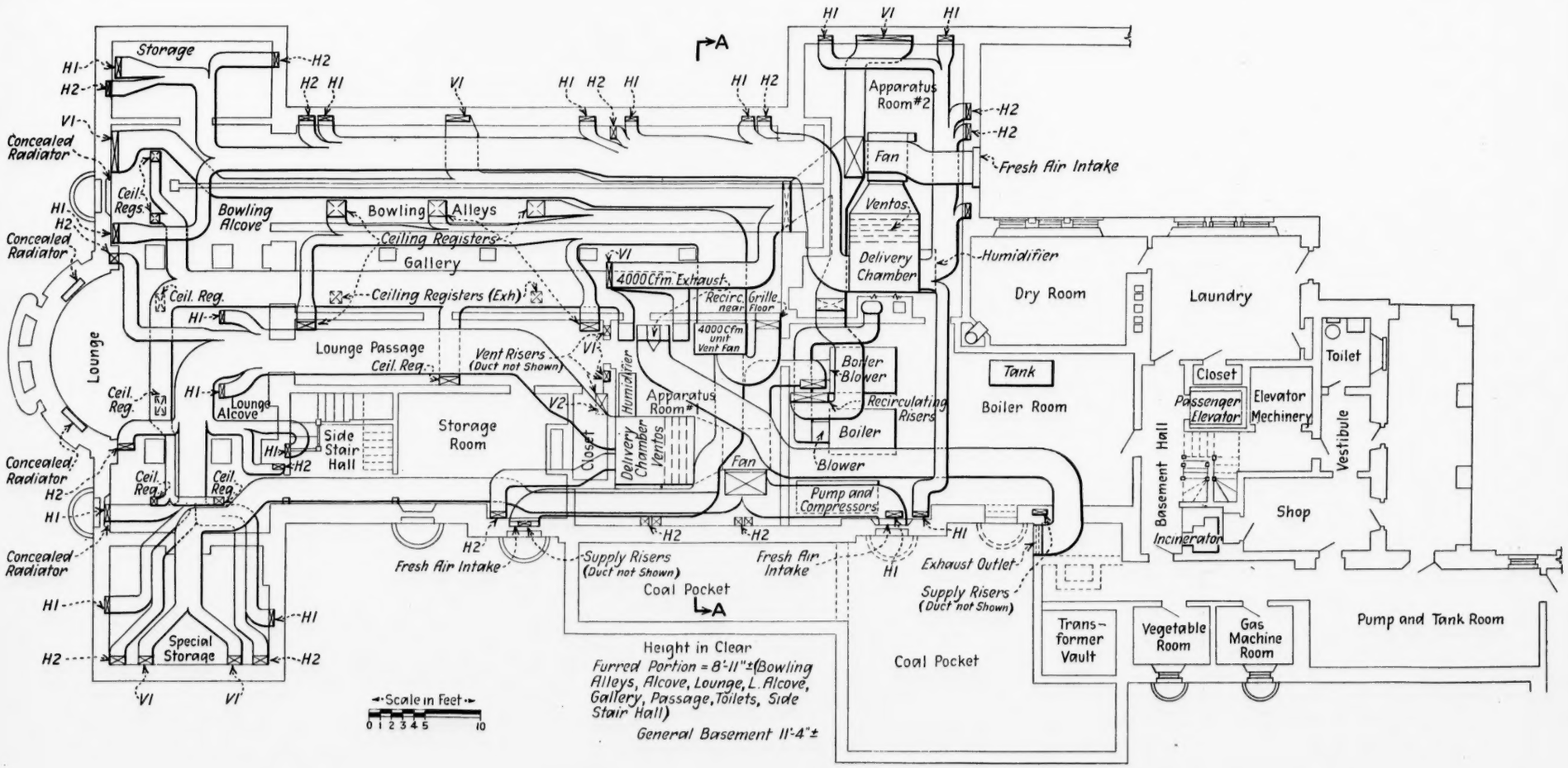
The central heating plant consists of two 14-section cast-iron boilers of the smokeless type, equipped for burning buckwheat coal. Each of two blowers located at the rear of the boilers delivers 700 c.f.m. of air at sufficient pressure to provide suitable forced draft for the combustion of the buckwheat coal. These are driven by 1/6-hp. totally-enclosed motors of the capacitor type, having spring-mounted bases to reduce vibration noises. The boilers are hand-fired, and every facility for conveying fuel from the adjacent coal pocket and the removal of ashes has been provided.

The heating system is of the closed type, with expansion tank in the basement, and two 3-in. by 3-in. air compressors, controlled by electric governors, maintain an air pressure of from 22 lb. to 25 lb. Forced circulation is accomplished by two centrifugal pumps. These are 3-in. single-stage double-suction pumps, mounted horizontally, and are fitted with monel metal shafts and bronze impellers. Special totally-enclosed constant speed motors of 1½-hp. capacity drive the circulators. Automatic air traps relieve air from the system.

Legless cast-iron radiators of the tubular type are used in the servants' quarters on the first, second, and third floors. The children's playroom on the third floor, all bathrooms, and the lounge and bowling alcove in the basement are heated by concealed convectors. The gallery, lounge, and bowling alley in the basement are heated and supplied with fresh air from a separate ventilating unit.

A unit humidifier is installed in each of two apparatus rooms in the basement. These are adapted for duct inlet instead of the usual inlet screen. Each humidifier consists of a set of spray nozzles, eliminator plates, heating coils, and a pair of fans for returning the air to the main delivery chamber. Water heated to approximately 200° by a coil connected to the boilers is circulated through the spray nozzles by a pump, belt-driven by the fan motor. The moist air is then passed through the eliminator plates and discharged through the heating coils at a maximum of 110°. Sludge and dirt from the spray water and eliminator plates are collected in the settling tank at the base of the humidifier, and the water is filtered and recirculated, together with the necessary make-up water.

The ventilating system provides for complete or partial recirculation of air throughout the master's part of the house, depending upon weather conditions. After passing through the main supply fan, approximately one-third of the air is drawn through the humidifying unit where it is washed and charged with moisture



RESIDENCE FOR MRS. MARY WELD PINGREE

WILLIAM T. ALDRICH, BOSTON, ARCHITECT HOLLIS FRENCH & ALLEN HUBBARD, BOSTON, ENGINEERS

Fig. 1. Heating layout in basement of Pingree residence

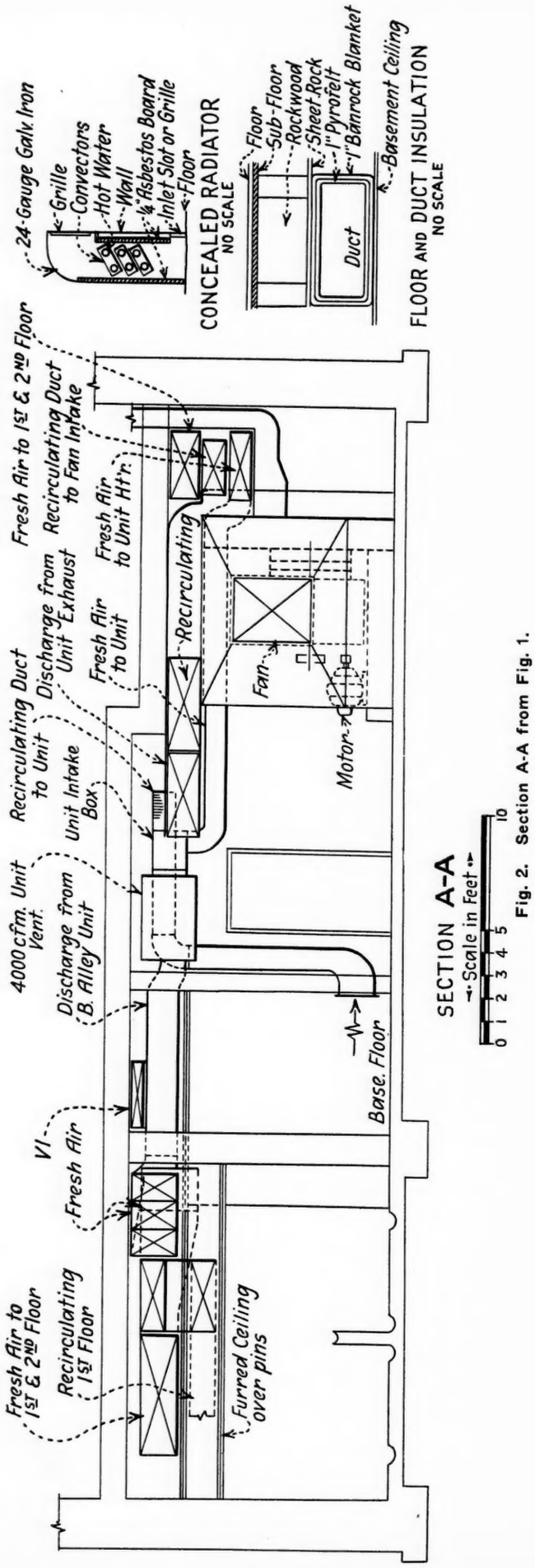


Fig. 2. Section A-A from Fig. 1.

nearly to the saturation point. The final humidity of the air discharged into the living quarters depends upon the temperature of the tempered air and upon the temperature and humidity of the air coming direct from the delivery fans. However, this is kept below a predetermined maximum by means of a humidistat placed in the return air duct between the make-up intake and the delivery fan. When the humidity in the return air duct reaches 50% or more a relay operates to stop the humidifier.

Cast-iron heaters are placed between the supply fan and the main delivery chamber to warm the air. Each of these heaters consists of four stacks built up of 24 sections, and hot water is circulated through them direct from the boiler.

Every precaution has been exercised in the design and installation of mechanical equipment and ductwork to minimize the transmission of noise and vibration. Canvas connections have been placed in the joints at fans, humidifiers, and delivery chambers in an effort to reduce vibration.

Since the bowling alleys are likely to be in use at times when the master's rooms are occupied and thus cause troublesome noise, a separate and independent system of heating and ventilating equipment, operating through an independent duct system, is used for this section. For this purpose, a unit heater of 4000 c.f.m. capacity circulates the air which heats the alleys, alcove, gallery, and lounge. Circulation is away from the alleys toward the alcove, to prevent the smoke from observers from obscuring the view.

A serious problem confronted the designers in locating the piping, ductwork, and control conduits between the basement ceiling and the first floor in such a manner that inspection facilities would be provided. This detail required close cooperation between the architects and engineers.

Space between the joists is packed with rock-wool, and sheetrock is nailed to the under side of the beams. All ducts and pipes are suspended beneath this insulating layer. Each duct is covered on all sides with mineral felt 1 in. in thickness, for both sound and heat insulation. Over the bowling alleys, lounge, and apparatus and boiler rooms an additional covering of insulating blanket is placed. All ducts are lined with acoustical insulation to a point 15 ft. from the delivery chambers. All ducts are concealed above the basement ceiling, and inspection doors with felt seats provide access.

Grillework in each room of the master's section is of ornamental design, and, although of large area to prevent air noises, is not conspicuous. The controlling thermostats are located in the return ducts behind the grilles, and are adjusted through invisible doors in the fretwork.

The electric control system by which the operation of all this equipment is regulated may be divided into six distinct groups. Group one includes the control for the two boilers and the draft blowers, the water temperatures for the radiator stacks, and the garage heating system. This consists of a thermostat with outdoor and indoor bulbs, and a water-temperature thermostat. The indoor-outdoor thermostat has one bulb in the flow line from the boilers to the radiator stacks, and

the other out-of-doors. These are adjusted to maintain a water temperature of 200° when the outside temperature is 0°. The instrument automatically lowers the water temperature 1½° for each 1° rise in outside temperature until a minimum water temperature of 130° is reached. Here the water-temperature thermostat cuts in and prevents the water temperature from dropping further regardless of the outdoor temperature. Both controls are adjustable, and the maximum and minimum water temperatures may be varied up or down as desired without disturbing the differential relationship between the outside temperature and the water temperature.

These instruments are wired to actuate a control motor connected to the check dampers in the boiler smoke pipes, and to flap dampers covering the air inlets to the two draft blowers. The motor also operates a mercury relay to start and stop these blowers. When either of the foregoing controls calls for heat the check dampers close, the draft dampers open, and the blowers start. When the conditions called for by both thermostats are satisfied, the reverse takes place.

A second group of controls regulates the operation of the two main delivery fans and the mixing dampers which adjust the amount of fresh air to be mixed with the recirculated air. The fans operate as long as any one thermostat in the master's rooms is exposed to a temperature lower than that for which it is set. Only when all thermostats are satisfied do the fans stop. Each fan may be independently controlled by a hand switch so that the system may be operated for cooling by air circulation during the summer.

A thermostat located in the extreme outer end of each of the two fresh air intake ducts governs the operation of the motor that regulates the mixing damper. These are adjusted to operate as follows: When the outside temperature is 50° or above, approximately 50% of the air is recirculated and 50% is taken from outside. If the outside temperature falls below 35°, 75% is recirculated, and when the outside air falls below 20°, all the air is recirculated and the make-up damper is entirely closed.

A constant temperature is maintained day and night in certain of the rooms of the master's section. Thermostats located in the return ducts behind the grillework in the dining room, main entrance hall, living room, library, and study regulate the automatic dampers in each warm-air supply duct. Thermostats located on the walls of the flower room, gallery, reception room, and the second-floor portion of the main stairhall control the discharge of warm air into these rooms. The automatic dampers in the discharge end of each concealed radiator in the children's playroom on the third floor are controlled by a wall thermostat. All thermostats are of the mercury-tube type, and all automatic dampers are located in the basement at the base of the risers, with the exception of those on concealed radiation.

A fourth set of thermostats of the duplex type regulates the day and night temperatures in each study and bedroom on the second floor. These duplex thermostats, in conjunction with an electric time switch in the basement, operate the dampers to automatically provide a different temperature for day and night operation. However, the day or night temperature of any room may be changed at will by the occupant.

A separate flow line from the boilers supplies hot water to all exposed cast-iron radiation in the servants' quarters, and a fifth set of controls regulates the operation of this part of the system. A motorized valve in the line is controlled during the day by a thermostat with indoor and outdoor bulb, and by a water thermostat during the night. The change-over is accomplished by a second time switch in the basement. These two instruments are in series with the first group of controls mentioned, and control the operation of the blower motor in conjunction with them.

For day operation this system is adjusted to maintain water at 190° when the outside temperature is 0°, and the water temperature is automatically lowered by 1¼° for each degree rise in outside temperature above zero. This continues until a minimum water temperature of 92° is reached, corresponding to an outside temperature of 70°. At a predetermined time, the time switch cuts the control over to the water thermostat, which is set to maintain a constant temperature of 110°.

A final group of controls regulates temperature and ventilation in the basement rooms. The cold air duct to the bowling alley unit heater has a damper in its outside end which is motor-operated by the unit heater control. This can be closed when the alleys are not in use. A mixing damper governs the amount of make-up air to be added to the recirculated air before it passes into the unit, and a temperature of 60° to 80° is maintained at the point of discharge into the alleys. The lounge and lounge alcove are heated by four concealed radiators, and a separate room thermostat regulates an automatic damper at the discharge of each.

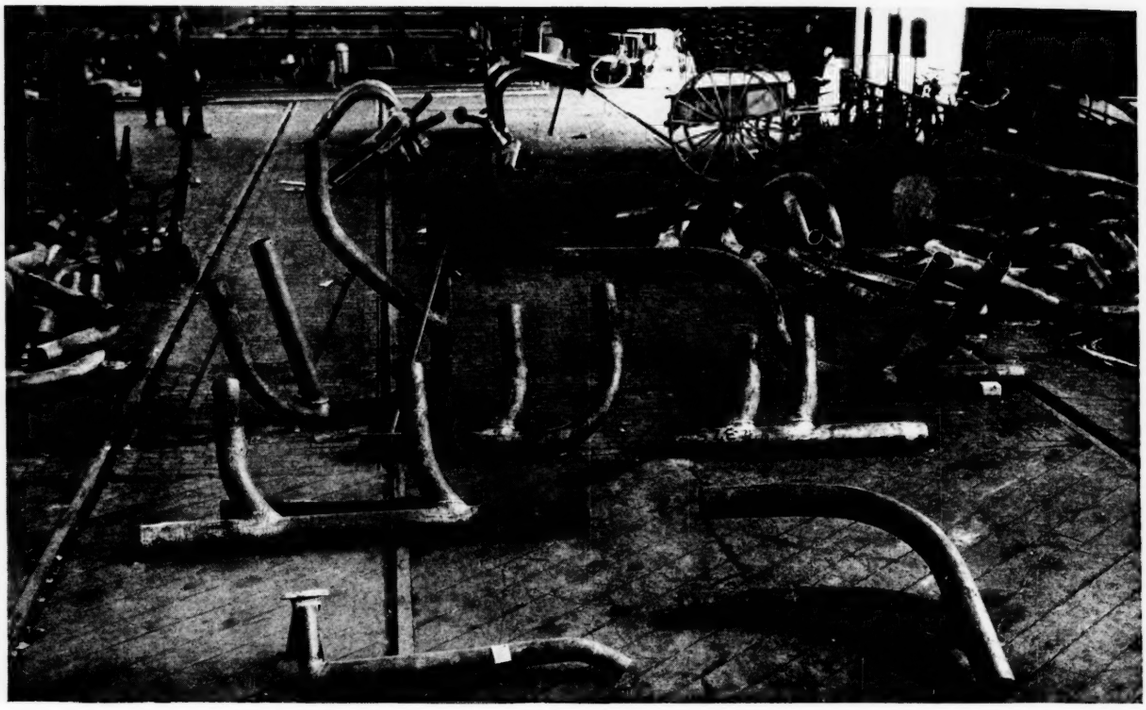
An exhaust fan of 3000 c.f.m. capacity ventilates the kitchen. Heat for cooking is furnished by artificial gas produced by a generator in the basement. All water used on the estate is supplied from a pumping and filtering plant which is equipped with auxiliary gasoline engines to carry the load in case of failure of the power service.

The architect for the building was William S. Aldrich, while the engineers were Hollis French & Allen Hubbard.

Equipment

Boilers—H. B. Smith Company.
Circulating pumps and draft blowers—Buffalo Forge Company.
Unit ventilators—Peerless Unit Ventilator Company and Buffalo Forge Company.
Cast-iron heating surface—American Radiator Company.
Concealed radiators and exposed cast-iron radiators—National Radiator Corporation.
Radiator valves—Hoffman Specialty Company.
Heat insulation—Johns-Manville, U. S. Gypsum Company, General Insulating & Mfg. Company, Mineral Felt Insulation Company.
Sound insulation—Celotex Company.
Controls—F. I. Raymond Company, Minneapolis-Honeywell Regulator Company, General Electric Company, American Moistening Company.

Some Applications of Pipe Welding†



DURING the past 15 years I have seen metal arc welding advance from minor repair work to a trade which today joins steel structures for every purpose, fabricates pipe lines, etc.

At the Norfolk Navy Yard, a number of craft have been built by all-welded construction, including battle towing targets, a 150-ton floating derrick, landing boats for the United States Marine Corps, motor boat hulls, lighters, and barges. A swimming pool has been built and blisters have been joined to the armor of four battleships that were modernized, superstructures built, and deck houses and various jobs requiring thousands upon thousands of lineal feet of welding have been done.

Many miles of steel pipe have been joined by welding with welded branches, eliminating flanges and fittings.

One of the metal working trades that offers great possibilities for the employment of welding is the piping business.

A 10-in. steam pipe line from one power plant to another, installed by the author, included 100 butt welds, 12 welded flanges for slip expansion joints, and also eight straps for anchors. The total cost of the job was as follows:

Welders		
Direct labor, 22 days @ $6.64	$146.08	
Moving equipment, etc.	22.00	
Overhead 50%, which included power	84.04	
Welding rod	21.60	
Total		$273.72
Pipefitters		
Direct labor, 25 days @ $12	$ 300.00	
Overhead 40%	120.00	
Pipe, 1500 ft. @ $2.10 per ft.	3150.00	
12 flanges	30.00	
6 expansion joints @ $90	540.00	
Bolts, gaskets, etc.	6.00	
Total		$4146.00
Total for job		$4419.72

The best estimate for lagging was $122 less for the welded line than for a flange and coupling installation. The total cost of the job had couplings and flanges been used would have been $5261.60.

I have made an installation in a single residence without the use of tees, ells, couplings, flanges, or unions, and without threading any of the piping, except where the main joined the cast iron boiler and the top of each riser where the radiator valve or ell was screwed.

Starting from the boiler the ells were made in the main by mitering and welding, the lengths of pipe were joined by butt welds, and branches were welded to the mains at the desired angles. The branches were bent to turn up, run in partitions, and offset to come out between the ceiling of the first floor and the floor of the second floor, with end of pipe threaded for radiator valve or ell.

This method reduced the not less than three sharp turns (ells) in each riser to easy bends, eliminating eddies and contraction veins in the flow, giving a more efficient heating system. The lagging is more uniform and gives better insulation. The circulation of this sys-

†Condensed from a paper by Charles O. Barclay, submitted in the Second Lincoln Arc Welding Prize Competition, sponsored by The Lincoln Electric Co., Cleveland, Ohio. It was awarded a prize of $100.

tem is better and the cost of fuel will be at least 10% less.

The saving on this job was 10% on labor and $2.50 on each radiator connected for tees and ells. The system has full thickness of pipe as threading would have cut away half the thickness of standard pipe. This feature alone will prolong the life of the pipe from the usual 10 or 12 years to 20 or 25 years.

Among the welded pipe lines in the Norfolk Navy Yard are the following:

Hot water heating mains (supply and return) ranging from 6 in. in diameter to 18 in. in diameter, with branches ranging down to 1 in. pipe, working pressure of 35 lb. There are steam main branches of all sizes. Our largest mains are 12 in. diameter pipe with working pressure ranging from exhaust steam to pressure of 150 lb. The welding of this system has been an enormous saving, as the flanged joints, screw joints, etc., formerly used required almost constant repairs.

By the use of welding, large jobs of pipe work are now completed in a few days that formerly required weeks for assembly of the pipe fittings. Short ends of pipe are used up in branches, miters, etc., that present such a problem to the pipe shop that does not employ welding. The costs of completed jobs show savings of from 10% to 50%, while the time required is usually less than one-half, and the upkeep of a welded pipe system is usually nothing, while the screwed or flanged bolted systems have to be tightened and packed frequently.

Pipe Work Aboard Ship

Approximately two-thirds of the piping aboard a ship is steel or wrought iron, and a greater proportion will be in time, as welding affords the installation of systems to meet the requirements of water-tightness and flexibility, impossible heretofore unless copper or brass was used.

A recently installed heating system in 92 fuel oil tanks on a battleship required 48,000 ft. of steel tubing of 1.05 in. outside diameter, 0.109 in. thick. The pipe was bent into spiral coils 12 in. in diameter and arc welded together, using tubing 14 ft. in length. Had flanges been used, the only other method that could have been employed would have required 3500 pairs of flanges, made-up with metal-to-metal joints, as gasket joints will not last in fuel oil. The cost of metal-to-metal flange joints on this size piping was $7 per pair, a total cost of $24,500.

In the method used, a sleeve 2 in. long was slipped over the pipe ends and arc welded, requiring two welds, making up sections as long as could be gotten in the tank manhole, and joined together in place, the supply and return pipe leading out through a flange welded on the tank top and expanded. The cost of each joint averaged 50 cents on the entire job, a saving of $22,750.

As each row of coils was completed a test pump was connected to the supply line, a vent and gauge fitted on the return line (all outside of the tank) and 350 lb. hydrostatic pressure applied, allowing the pressure to stand 30 min. No drop of pressure whatsoever was allowed, insuring an absolutely tight job. The system as installed is a complete one-piece homogeneous pipe, leading into the tank, coiled up 12 in. in diameter, 400 ft. to 600 ft. long each circuit, and out of the tank. These will not require tightening from time to time as would be the case with flanged joints. The life of these coils is much longer than the life of the ship.

A heating system that I will start and complete within the next 30 days is on a fuel oil tanker, with 16 large cargo tanks. It will require 28,000 ft. of steel tubing, 1.90 in. outside diameter, and 0.109 in. thick. The work as planned allows the pipe to be bent in returns 12 in. on centers and welded up in sections that could be gotten through a 4 ft. x 6 ft. hatch, then bolted together with flange metal-to-metal joints, requiring 1050 pairs of flanges. The cost of each flanged joint would have been $9. After a consultation I succeeded in getting them to allow the omission of the flanges and the welding together of the coils in place at a cost of $1.50 per joint, a saving of $7875.

The system is now a far better job, and if sections ever have to be renewed, they can be renewed by either welding in new sections or cutting out the old sections and replacing with flanged sections, expanding two flanges on the pipe in the tank and making up a flange section and bolting in place.

A welded pipe line does not require the constant tightening of joints that the flanged or screwed lines require because there are no joints to tighten, the line forming one continuous pipe.

The saving on cost of a welded line depends largely on the number of branches, bulkheads, etc., but usually runs 25% less than the line made up of flange fittings.

Washed Air to Preserve Book Bindings

IT has been suggested that in the future libraries will be forced to circulate washed air in order to remove the impurities that destroy beautiful and expensive leather bindings on books. Results of an experiment recently completed by the Department of Agriculture in Washington, and reported to the American Association for the Advancement of Science, indicates that the damage is done by acids present in the air which are formed from the sulphurous products of combustion from power stations and industrial plants.

Dummy leather-bound books were exposed for eight years to the air in the vicinity of several Government power plants and the main line of a steam railroad, and it was found, upon comparison with similar bindings stored in a protected atmosphere, that the leather of the exposed volumes was powdery and easily torn and cracked, while the protected leathers were sound and durable as in the beginning. The high temperatures usually encountered in the stacks and shelves of libraries would hasten the reaction, according to the late R. W. Frey, of the Bureau of Chemistry and Soils, who rendered the report.

Abstracts . . .

Reviews and Summaries of . . . . Current Papers, Books and Pamphlets

Fundamentals of Instrumentation

By M. F. Behar

Part I of a manual of instrumentation published by the Instruments Publishing Company, Pittsburgh; cloth-bound book of 109 pages; illustrated; 6 in. x 9¼ in.; price $2.

The book treats the fundamentals under the four heads of: Industrial Instruments—General; Properties and Characteristics of Industrial Measuring Instruments; Performance of Automatic Controllers; The Plant Instrument Department. In addition, there is a rather complete bibliography. The first three parts contain elaborate discussions of the fundamentals, while the fourth part considers the matter of organizing plant instrument departments in order to obtain effective use of the stock of instruments which a plant finds it necessary to maintain.

Characteristics of the author's style are the completeness of the discussions, the breadth of view with which these are presented, and the informal tone given both by the extended preface and the frequent use of explanatory footnotes throughout the book.

Features are the classification of instruments given, the photographs used to illustrate instrument types, and the curves used in explaining the properties of instruments.

Instrument men who wish to follow a really comprehensive outline of instrumentation will find the book a source of ready information and reference.

●

Water as a Refrigerant

By John Everetts, Jr.

Paper presented at the annual meeting of the A.S.R.E., December, 1932; illustrated with graphs and photographs; approximately 2000 words.

After reviewing the history of the use of water as a refrigerant, the author passes to present considerations applying to a refrigerant for air conditioning work and mentions the variable nature of such loads, and the difficulty caused by the problem of toxicity of the common refrigerants. Regarding the use of water he notes that it may be used either with an ejector or a mechanical compressor, and in discussing this, calls attention to the advantage in first cost when multiple jets are used, and to the possibility of so sizing the jets relative to the maximum load that greater flexibility of operation can be secured. He points out also the limited possibility of throttling the steam supply to take care of load variations and the effect of the initial steam pressure on the steam consumption.

One of the weaknesses of the use of the ejector is the increased condenser water required, compared to a compression method. In an example cited, he finds that 41,600 B.t.u. per hr. per ton must be removed at the condenser compared to about 15,000 B.t.u. per ton with a compression system. However, the actual water required is modified by the advantage gained by the ejector method when a cooling tower is used, and because of the large proportion of its heat which varies with the load. He also states that "If condenser water or the pumping cost is expensive, the jets can be designed to operate against a higher condenser pressure, which, it is true, requires more steam per ton, but as the outlet water temperature can be much higher, the resultant quantity of water is reduced."

Regarding the comparative operating costs of the ejector method and the compression cycle, the author feels that this is too much a function of the particular installation to permit any general statement.

He concludes with the statement " . . . it seems from the many analyses we have made that the use of water as a refrigerant has great future possibilities for high temperature work, especially in the air conditioning field. Although the steam ejector now holds the field as the best method of producing refrigerating effect from water, considerable research and experimental work are now going on to perfect a rotary compressor or other methods equally as efficient to do the work."

●

The Propeller-Type Fan

By O. G. Tietjens

A.S.M.E. paper, Applied Mechanics Section, presented at June, 1931, meeting at Purdue University, Lafayette, Ind.; 19 figures and graphs; approximately 8000 words.

An analytical and mathematical treatment of the propeller fan, and of the application of the aerodynamic theory to it. Includes a method of presenting fan characteristics concisely, and an outline of a testing plant used to study the question of propeller vs. centrifugal fans. Author gives equations for use in determining the principal items in fan design when the power output is known. Considerable attention is given to a discussion of the limitations of the theory used. Paper is distinctly not for fan application, but is of interest to the fan designer primarily.

●

Pulsation of Air Flow from Fans and Its Effect on Test Procedure

By Harold F. Hagen

A.S.M.E. paper, annual meeting 1932; illustrated with graphs; approximately 3000 words.

After discussing errors in the results of fan testing using standard methods when there is a pulsating flow, the author analyzes the errors in certain cases and finds that they are large. A device for producing a photographic record of the air pulsations is described and records obtained by its use are included. The testing

set-up used by the author in the special tests which he describes differs from the usual standard method in that a flow nozzle is used in addition to a pitot tube traverse. He shows that with this set-up he gets test data which indicate that the volume of air shown by the pitot traverse is often considerably greater than that shown by the nozzle measurement. The amount of the divergence in results varies greatly with the type of fan tested.

Because of these observations of discrepancies in the test results, the author suggests modifications of the standard fan test procedures.

His suggestions and conclusions follow:

"Test procedure, therefore, ought to result in a determination of the presence or absence of pulsation error. With the instruments at present available to the industry, this information can best be secured by making two volume determinations—one by the usual pitot tube traverse method, and one by a nozzle determination at higher velocity. Many engineers dislike the pitot tube traverse, but it seems to the author from the work in connection with this investigation that the pitot tube traverse is an extremely accurate method of determining the average velocity pressure in a duct. If, as the result of pulsation, this velocity pressure is incorrectly interpreted as corresponding to the average velocity, the error is with the interpretation and not with the instrument.

"It would seem, therefore, that an agreement between the volume determined by the pitot tube traverse and the volume measured at the mouth of the flow nozzle should be the criterion of correctness of result. A disagreement between these two volumes could safely be accepted as an indication of a pulsation that must be considered.

"In extreme cases of difference between pitot tube traverse and nozzle volumes and where a high degree of accuracy is required (as, for example, when noting the effect of small changes in fan proportions) an additional run of pipe and an additional small nozzle may be used, employing an auxiliary fan, if necessary, to get the required volume through the system. Agreement between the two nozzle volumes determined at different velocities could serve as the required indication of a correct measurement.

"It has been noticeable in all the work that the pulsation error is greatest with the larger outputs and that close agreements between pitot tube and nozzle are readily secured at the smaller volumes.

"With propeller fans tested on the outlet side, there seems to be little hope for any consistency. Tests indicate errors of the same general order of magnitude as given in the table for centrifugal fans, but results are widely varying and cannot readily be checked. Contrary to expectation, no difference could be observed in the results of pulsation between two-bladed fans and six-bladed fans. Careful investigation and test reduced the reported efficiencies of these propeller fans to a reasonable point and indicated that the apparently extreme efficiencies were due to a combination of pulsation error and the almost classical mistake of crediting velocity pressure in the fan intake to static.

"The standard procedure for testing propellers provides for readings on the inlet side and the use of a centrifugal fan to overcome the resistances of the duct and drum. Obviously, the results may contain pulsation error, due not only to the action of the propeller fan, but also to the working of the auxiliary, so that propeller fans under customary test methods will give results that vary with the particular centrifugal fan that is connected to the test duct. Even on the inlet side, before the air has passed through the propeller fan, the pulsation appears.

"It is proposed, therefore, that for the determination of the volumes handled by propeller fans the same general procedure be followed as has been advocated for centrifugal fans; namely, a pitot tube traverse in the inlet duct and a nozzle determination from a nozzle half the diameter of the duct and discharging directly into the drum from which the propeller fan exhausts. The same requirement for an agreement between the two volumes thus determined would apply.

"From these analyses and tests the following conclusions seem allowable:

1. A variation of velocity can exist in the flow of air past a fixed point.
2. This changing velocity results in an average velocity pressure higher than that corresponding to the average velocity.
3. There can be no certainty of accurate volume determination if the fluctuations are extreme and, consequently, accurate testing requires controlling evidence of the magnitude of fluctuation. This evidence may be secured by comparing two volume determinations made at different velocities. A close agreement implies small pulsation and correct results.
4. In most cases, and as customarily employed, the flow nozzle will give volumes more nearly correct than those determined by pitot tube traverse."

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House Design, Construction and Equipment

Published by the President's Conference on Home Building and Home Ownership; cloth-bound; illustrated; obtainable by addressing the publisher at Washington, D. C.; price $1.15 postpaid; 325 pages; 6 in. x 9 in.

This is the fifth volume of the series resulting from the papers presented at the conference in December, 1931, and includes those papers on planning and design, construction and materials, and mechanical plants and services. The heating and ventilating section comprises about 50 pages, but the other sections also contain material of interest on sanitation, lighting and kitchen equipment.

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Air Conditioning Theory

By J. A. Goff

Paper presented at the A.S.R.E. annual meeting, December, 1932; illustrated; largely mathematical; approximately 3500 words.

A statement of the properties of air and steam mixtures set up in thermodynamic terms and symbols. Includes equations for finding the mechanical properties of saturated and unsaturated mixtures and the heat content of unit weights of the mixtures; equations ap-

plicable to mixing processes and to finding special properties of unsaturated mixtures, such as relative humidity, dew point, and wet bulb temperature. The paper closes with sample calculations and the solution of examples involving both heating and humidifying and cooling with dehumidification.

This well prepared statement—perhaps the first set up in consistent thermodynamic terms—should serve as a fine basic reference to anyone who wishes to get a scientifically formulated outline of the underlying theory.

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Automatic Coal Heat with Mechanical Stokers

A mimeographed pamphlet published by the Committee of Ten, Coal and Heating Industries, Chicago, Ill., as its Educational Bulletin No. 5; price 25 cents; 43 pages; 8½ in. x 11 in.

Written in popular style to appeal to the layman, this bulletin is a compilation of information from numerous sources in such a way that it should be useful to anyone who wishes general information an the small automatic stokers intended for use in small buildings. Included are short descriptions of stoker types and controls, a statement of efficiencies, a considerable amount of material relative to comparative fuel costs, a rather extended list of stoker terms, and data for finding stoker sizes.

●

Fuel Economy in Domestic Automatic Heating

By Howard H. Langdon and Homer J. Dana

Engineering Bulletin No. 39, Engineering Experiment Station of the State College of Washington; illustrated; obtainable by addressing the Station at Pullman, Wash.; 46 pages; 6 in. x 9 in.

A running account of the testing methods used and the results obtained during a series of tests made in hot-water heating plants actually installed in residences and fired by hand, by automatic stokers, and by an oil burner. In addition, the bulletin also included some supplementary material incidental to the main tests. Among these items are a description of a meter developed to insert into the hot water pipe leaving the heater, *and intended* to measure the heat output. Another is some values of the coefficient of heat transfer for the boiler iron, values of which have not heretofore been published.

The bulletin tells of the results obtained when two houses were heated during two different seasons in such a way as to permit a fuel-cost comparison between oil and coal.

The principal tests were six in number. Heat balances were obtained during each and the plants were set up to bring out the efficiencies and sources of loss when hand-firing with coal was used, stoker-firing with a special stack economizer installed, and when using a specially-designed heater. The results showed that the substitution of an automatic stoker for hand-firing resulted in an increase of 16.2% in efficiency, although the dollar cost of heating was not in this ratio as a difference in cost of coal was involved, and because the automatic control kept the house more uniformly heated. (Editor's Note: Although the bulletin does not mention the point, it may be noted that the economy of the stoker-fired installation depended largely on its ability to use a cheaper coal. This point is often overlooked, and a stoker installation which fails to use a cheap fuel, either because of inability to handle the cheap coal, or through failure of its owner to use it, may save little or nothing in dollars over hand-firing. The test result reported brings this out very well.)

Having obtained an increase by the use of an automatic stoker, a specially-designed furnace intended to assist combustion was next tried. This resulted in a further increase in heating efficiency of from 10% to 15% depending on the rate of stoker feed and the cleanliness of the heating surfaces. Details of the heater which permitted these increases are not shown.

A desirable feature of the bulletin is the use of graphical charts to show the results. As intermittent firing was used, these graphs give a good picture of the changes occurring in the furnace and heating system.

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Carbon Monoxide Survey in Liberty Tubes, Pittsburgh

Journal of Industrial Hygiene, October, 1932; from a report of June 4, 1932 to the chairman and members of the Board of Commissioners, Allegheny County, Pa.; approximately 1500 words.

A preliminary report covering the findings of the study of CO concentrations in the Liberty Vehicular Tunnel. The Tunnel consists of two identical parallel tubes 5888 ft. long, and of 468 sq. ft. sectional area each. Roadways are 21 ft. wide and there are two sidewalks 2½ ft. wide. Ventilating system consists of sirocco-type fans in a fan house located slightly south of the midpoint. Contaminated air is drawn from the tunnel to the midpoint and discharged through a stack. Fresh air is delivered to the tube through a shaft from the midpoint to the exit. Normal operation of fans is 50 r.p.m. exhaust and 75 r.p.m. supply.

Concentrations of CO varied from 100 parts per million to 640 p.p.m. during peak hours of traffic. The following results were recorded:

1. Highest traffic count, 284 cars in 5 min.
2. Brief jams or stoppages of traffic frequent during peak periods.
3. CO concentration often exceeded a desirable maximum.
4. Increasing fan speeds did not decrease CO concentration to degree expected.

The following recommendations were among those made:

1. Minimum speed of vehicles during peak hours, 25 m.p.h.
2. Pedestrian use restricted during peak hours.
3. Ventilating system operated at speeds to conform to the demands upon it. Power saving would result. CO indicator at each side of each tube.
4. Steps taken to prevent slowing up or stopping of traffic.
5. A more complete study to include sampling at different levels and different points to determine variations in concentration with traffic densities and relative humidities.

Your Everyday Problems

HEATING AND VENTILATING will be glad to answer your problems relating to installation and operation of heating and ventilating systems. Letters will be answered promptly, and in some cases published anonymously. If sketches are included they should be clearly drawn. Write The Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York.

QUESTION 66. *We have a 5-hp. 3-phase squirrel cage motor direct connected to the impeller of a centrifugal circulating pump. The motor is of ample capacity to carry the pumping load, but we are experiencing difficulty in starting, frequently burning out one or more fuses. Can you suggest the probable cause of the trouble, and recommend a remedy?* *J. F.*

ANSWER. This type of motor often draws from two to six times its rated full load current when started under full load. The power input to a pump increases as the quantity of water delivered from its discharge increases, and therefore the current drawn by the motor is equal to the starting current of the motor plus the current required to move the weight of water delivered from the pump. Therefore, if the pump can be prevented from discharging against a head while the motor is starting, preferably by closing a discharge valve or opening a by-pass around the pump, the only load on the motor other than friction and inertia is that resulting from turbulence within the pump. Under these conditions, the motor should pull up to speed without drawing excessive current, and the discharge valve may then be opened.

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QUESTION 67. *In a description of a small experimental heating system operating on the reversed refrigeration cycle it is reported that 265,200 B.t.u. are added to the air in the building per hour. This is said to be accomplished by the operation of a 5-ton compressor driven by a 25-hp. motor. Assuming the motor not to be overloaded, this would indicate a total equivalent heat input to the system of 25 × 2545 = 63,625 B.t.u. per hr. Apparently something over four times as much heat is being supplied by the apparatus than is being put into it, resulting in an efficiency of over 400%. Can you explain how this is possible?* *R. J. M.*

ANSWER. The heat output from a reversed refrigeration heating system does, at first sight, apparently operate at an efficiency greater than 100%, but an investigation of the thermodynamic principles involved will quickly reveal the fallacy of this conclusion. This was numerically discussed on pages 45-48 in HEATING AND VENTILATING for November, 1931, but the following qualitative consideration may serve to indicate the possibilities of the system.

Aptly termed a "heat pump," the reversed refrigeration cycle does not generate heat as does, for example, a system in which steam is generated by the heat released by the combustion of fuel beneath a boiler. Rather, it is a device whereby heat stored at low temperature in some substance is transferred to another substance at a higher temperature. Applied to heating a building, it abstracts heat from the air outside the building at, say, 40°, and adds it to the air within the building at, possibly, 70°. The following familiar analogy should make clear how this can be done.

A feed pump is returning water at 180° to a boiler against a pressure of 250-lb. gauge. Each pound of water at 180° contains approximately 142 B.t.u. of heat energy and, therefore, adds this much heat to the system within the boiler, and 1 cu. ft. of this water will add 8,800 B.t.u. of heat to the system. To force the cubic foot of water into the boiler against the pressure, approximately 264.7 × 144 × 1 = 38,100 ft. lb. of mechanical energy must be supplied by the pump. This is equivalent to 38,100 ÷ 778 = 49 B.t.u. of heat energy. We have added, therefore, 8,800 B.t.u. to the water within the boiler at an expenditure of only 49 B.t.u. This is precisely what the "heat pump" does when it abstracts heat from the air outside the building to evaporate the liquid refrigerant after it has given up its heat in the condenser within the building.

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QUESTION 68. *My home is heated by a gravity hot water system using an oil-fired boiler, and with an expansion tank in the attic. Two radiators on the top floor are extremely slow in heating up, and often fail to heat up at all. These are below the bottom of the expansion tank and should therefore be full of water. I also find it frequently necessary to add considerable quantities of water to the system, although I can find no leaks in the piping or boiler. Can you suggest the cause of these difficulties and how they can be remedied?* *L. K. G.*

ANSWER. Your difficulty is probably due to a common installation error—that of connecting the expansion tank to the supply line from the boiler. When the water in the system is heated it expands and is discharged from the overflow. When the water cools during the shut-down period, it contracts sufficiently to drop it below the top floor radiators, thus admitting air to them. When water is added to the system, this air is pocketed in the radiators and they fail to heat up due to air binding. This air may be relieved by means of the air valve in the side of the radiator.

Expansion tanks should never be connected to the flow side of the system, but rather to the return. This connection may be made in the return line close to the tank. Connection of the tank to the boiler is desirable if this can be done without running the pipe too great a distance. With this connection, air will not be trapped in the radiator, resulting in airbinding and loss of water from the system due to displacement.

QUESTION 69. *We are distributing steam for heating, sterilizing, etc., to a group of hospital buildings at a pressure of* 50 *lb. per sq. in. Replacement of the present boilers has become necessary, and it is intended to operate the new boilers at* 100-*lb. pressure. What will be the increase in coal consumption at this higher pressure? No change in the load is contemplated.*

A. E. R.

ANSWER. The increase in coal consumption will be very slight, probably not more than 1% per pound of steam generated, and since the 100-lb. steam is at a higher temperature than the 50-lb. steam, a correspondingly smaller weight of steam should be required to carry the same heating and process load. If the feed water be returned to the new boilers at the same temperature as it is to the present boilers, and assuming this temperature to be 212°, the input per pound of 50-lb. steam will be 998 B.t.u., and the input per pound of 100-lb. steam will be 1,006 B.t.u., a difference of approximately 1%, if we disregard the added power expenditure of returning water against the higher pressure as negligible. Therefore, approximately 1% less steam should be required to transmit the same amount of available heat.

There will, however, be a slight increase in heat loss in the distributing system, as the steam in the pipes will be at a higher temperature. This loss will depend upon the condition of these pipes and their coverings. There will also be a greater amount of heat lost to the stack as a result of the hotter fire. However, these losses will probably be more than compensated by the increased efficiency of operation of the new boiler equipment with its clean surfaces and possible improved design, and it is more than likely that your actual experience with the new high-pressure boilers will prove that less coal will be used in operating the plant than under the present conditions, at least as long as the boilers stay clean.

The important point is that the moderate change in pressure you mention will not in itself result in any sizable change in the fuel used, but attention to other details may do so.

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QUESTION 70. *I would appreciate an explanation of the action of ozone in the removal of odors. Does it actually destroy the odor-producing material in the air, or does it simply render it imperceptible?*

E. M. E.

ANSWER. Oxygen, in the gaseous state in which it is found in the mixture we know as air, consists of molecules each made up of two atoms of elementary oxygen. Ozone is a special form of oxygen, the molecules of which contain three atoms of elementary oxygen. In this state the material is an extremely active oxidizing agent, and will react with nearly all metals and organic substances. It exists in nature in small quantities at high altitudes and over bodies of water, and may be produced artificially by means of an electric discharge.

Ozone has a strong penetrating odor which is perceptible when it is present in the atmosphere in concentrations as dilute as one part in 100 million parts of air by volume. The effect of ozone was thought in the past to be a masking action, but more recently the tendency is to hold that it is purely an oxidizing process. Most odors encountered in ventilating problems result from hydrocarbon compounds suspended in the atmosphere in minute quantities as a result of human or animal respiration, and from various organic processes. These hydrocarbons are immediately oxidized upon coming into contact with the ozone, the resulting products being water and carbon dioxide, both odorless. This process is effective in completely removing the odors if the reaction is complete, which requires that the ozone be introduced in sufficient quantity, and in such a manner as to insure its even distribution throughout the air.

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QUESTION 71. *Can the steam ejector system of refrigeration be operated on low-pressure steam from a cast-iron boiler? This imposes a limit of* 15 *lb. per sq. in. as the maximum pressure.* *S. G. T.*

ANSWER. Steam ejector refrigerating equipment is available for operation on any steam pressure from atmospheric up. A high vacuum is maintained by the condenser, and the pressure differential so produced is sufficient to operate the apparatus on extremely low gauge pressures.

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QUESTION 72. *Would like a practical method for eliminating noise in the water pipes in my home. It is presumably caused by air in the pipes and results in a heavy thump when the quick-compression faucets are closed.* *N. E. G.*

ANSWER. The noise which you describe as a heavy thump coincident with closing the quick-compression faucets is probably not due to air in the pipes but to water hammer. When the flow of water in the pipes is suddenly arrested by the closing of a faucet, the water adjacent to the faucet is subjected to compression due to the increase of pressure resulting from the inertia of the water upstream from the obstructing valve. Being to an extent elastic, a wave of extremely high pressure is propagated back through the water in the pipe away from the faucet, which may be intensified by branches with closed ends, reducing fittings, etc.

This condition may be remedied by reducing the pressure in your system by installing a reducing fitting or hand-closing valve in the supply main. In this way the supply is also cut down, and for that reason it may not be desirable. Substitution of hand-closing faucets for the quick-closing type might be a more satisfactory solution to the problem in your home.

Water hammer may be effectively reduced by the addition of air chambers or relief valves, usually installed at the pipe ends. This procedure would require considerable trouble and expense in the case of an existing house. If you are troubled with air in the pipes, a complaint should be made to the municipal water commission, as the air can only enter the mains at the source of supply, and can be eliminated there more easily than you can do it yourself.

ESTIMATING DUCTWORK

Weights of Rectangular Galvanized Steel Ducts per Foot

A series of 8½ in. x 11 in. Reference Data sheets for your notebook starts with this issue of HEATING AND VENTILATING. Sheets 1 to 8, inclusive, are for rapid calculation of the weights and surface of ducts. The weights are based on commonly used standards, and include allowance for seams, on the assumption that ducts are cut from 30 in. wide sheets, and that one lap of 1 in. is required for each sheet. Thus, ducts up to 29 in. perimeter allow 1 in. lap; from 30 in. to 59 in., 2 in. lap, and so on up to a 60 in. x 60 in. duct which has an allowance for 9 in. lap. No allowance is made for waste, bracing, or hanging.

The inclined line divides the tables into two parts. Weights for sizes found to the left of the diagonal line are in the bottom six lines, while the weights in the top six lines are for sizes to the right of the diagonal. The figures are so arranged that all ducts having the same perimeter appear in the same vertical column and, therefore, have the same weight and area of surface.

Example: Find the weight of 26-gauge galvanized steel in a 4 in. x 10 in. duct 45 ft. long. Also find the area to be covered by insulation.

Solution: In the first and last vertical columns of Sheet 2, reverse side of this page, we find the dimensions of one side (either side) of the duct. Opposite 4 in the first column we move horizontally until we find the figure 10, which is to the *right* of the diagonal, so that our results are to be found at the *top* of the chart. Following upward from the 10 we find that the duct has a surface area of 2.33 sq. ft. per lin. ft. In the second, and in the next to last, vertical column we find the gauges of the sheet, and we see that opposite 26 and above the 10 that 2.20 lb. of metal is required per foot of duct. If 22-gauge metal has been used, 3.38 lb. per ft. would have been needed.

By calculation the weight of the duct is 45 x 2.20, or 99 lb., and the surface area is 45 x 2.33, or 104.9 sq. ft.

To determine weights of ducts made of galvanized steel heavier than 16 gauge or lighter than 26 gauge, use the following method: For the heavier gauges, follow the usual procedure and find the weight of metal required for a 16-gauge duct. Multiply the result by 1.22 to obtain the weight of a 14-gauge duct, and by 1.67 to obtain the weight of a 12-gauge duct. For the lighter gauges, follow the usual procedure and find the weight of a 26-gauge duct, and multiply the result by 0.78 for a 28-gauge and by 0.73 for a 30-gauge duct.

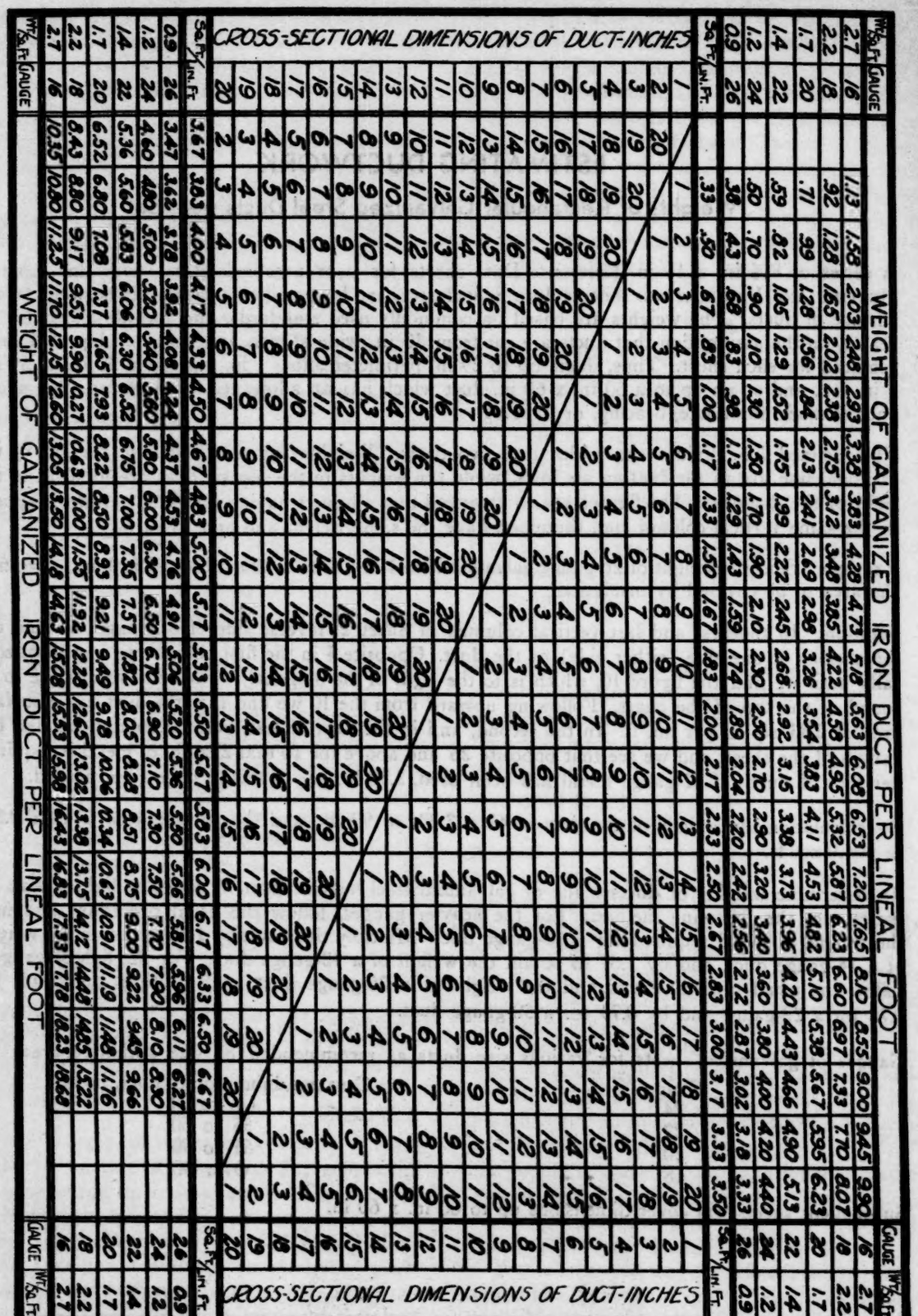
Gauges of galvanized sheets for various size ducts as recommended by one authority are:

Gauge	Greatest dimension of duct, inches
24	Up to 34
22	35 to 60
20	61 to 90
18	Over 90

Subsequent sheets will cover dimensions up to 60 in. x 60 in.

ESTIMATING DUCTWORK

Weights of Rectangular Galvanized Steel Ducts per Foot—1" x 1" to 20" x 20"


WEIGHT OF GALVANIZED IRON DUCT PER LINEAL FOOT
CROSS-SECTIONAL DIMENSIONS OF DUCT-INCHES
Wt. Sq. Ft. Gauge
Sq. Ft. Lin. Ft.
1" x 1" to 20" x 20"
WEIGHT OF GALVANIZED IRON DUCT PER LINEAL FOOT

Published by Heating and Ventilating, 148 Lafayette St., New York.

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H. & V.'s REFERENCE DATA—2

News of the Month

Williams and Land Address Acetylene Association

Welded piping was the topic for discussion at the Thursday morning session of the 33rd annual convention of the International Acetylene Association, November 16-18, at the Penn Athletic Club, Philadelphia. The first speaker was Dr. S. Lewis Land, educational director, Heating and Piping Contractors National Association, who presented his paper, "The Training of Journeymen Welders," in which were outlined the various facilities available for the training of welders, pointing out the importance to the industry of developing skilled operators.

This was followed by "Welded Piping in a Central Heating and Power Plant," a paper by R. D. Williams, of Baker, Smith & Co., New York, a non-technical outline of the numerous ways in which welding is used in fabricating the systems through which steam is supplied and distributed in buildings.

Fred Maeurer, of Air Reduction Sales Co., New York, next addressed the group on "Economies of Welded Piping in Homes," in which a comparison was drawn between the costs of installing threaded pipe heating systems and the cost of similar systems using welded piping.

York to Install Largest Air Conditioning System

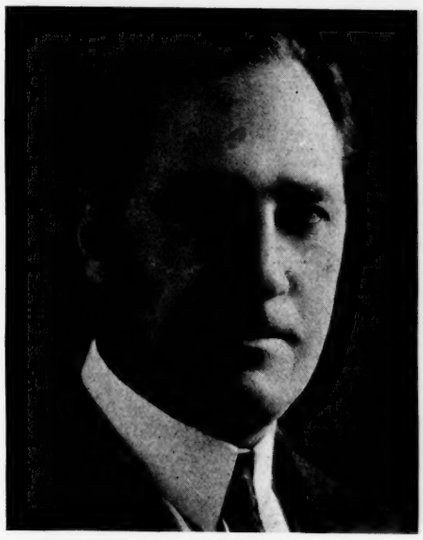
York Ice Machinery Corp., York, Pa., has been awarded the contract for what is to be the largest single installation of refrigerating equipment for air conditioning work ever projected. This installation will be made in the new Department of Justice Building, Washington, D. C., already under construction and scheduled for occupancy on or before July, 1934. Three large freon compressors are to be used to provide cooled air to the estimated 3000 occupants of the 1500 rooms of the building. The refrigeration effect will be equivalent to 2000 tons every 24 hr. A similar system, having a capacity of 1450 tons of refrigeration, is to be installed in the new Post Office Building.

Refrigerating Engineers at Their Annual Meeting Hear Papers on Comfort Cooling

Four papers on air conditioning were presented at the twenty-eighth annual meeting of the American Society of Refrigerating Engineers, held in New York, December 7-9.

Air conditioning was the sole subject discussed at the first session, December 7. John Everetts, Jr., engineer on the staff of W. L. Fleisher, presented a paper, "Water as a Refrigerant," in which the speaker gave a historical review of the steam ejector method of refrigeration, followed by a discussion of the advantages and disadvantages of this method of cooling, together with a discussion of the possibilities of such systems. The author presented a number of illustrations by lantern-slides showing diagrams and charts pertaining to steam ejector refrigeration.

"Comfort Cooling with Ice" was the subject of an article by George B. Bright, consulting engineer, Detroit, who presented numerous data on actual installations made in Detroit, using ice as the refrigerant. The installations included a commercial office, a residence, and a private office. With a $5 per ton ice rate, the operating cost ranged from 1.6 cents to 4 cents per hour per 1000 cu. ft. of content.



O. W. OAKLEY
new president of A.S.R.E.

Mr. Bright discussed the need for a compilation of data showing the number of days in various localities in which temperatures are such that cooling is needed. Such data should include the number of days the temperature is above 75°, 80°, 85°, etc. He also suggested that inasmuch as the consulting engineer bases his calculations on B.t.u. per hour, the refrigerating machines should be so rated, rather than by the present rating of tons of ice per day. L. L. Lewis, chief engineer of the Carrier Corporation, and W. L. Fleisher, consulting engineer, both supported Mr. Bright in the latter suggestion.

Mr. Fleisher in the discussion pointed out that in some cases it might be advisable to install an ice-making machine on the site of a job to be air conditioned, rather than using mechanical refrigeration direct, or purchasing ice from manufacturers. As an example, he mentioned a plant where the maximum load was 30 tons, and where the maximum load was reached only for a few hours out of the day. In this case, an 8-ton ice machine working 24 hr. per day could supply all the ice required. Such a method would reduce the fixed charges on the larger machine and give a more favorable total cost.

Tables giving the properties of air and water mixtures necessary for air conditioning calculations which have been in use have been somewhat in error in the neighborhood of 32°. Corrected tables have been worked up and were presented before the meeting by John A. Goff, associate professor of thermodynamics, University of Illinois, in his paper "Air Conditioning Theory." Mr. Goff's paper was a discussion of the thermodynamics of air conditioning, and one of the points brought out was that the term "heat content" is misleading, inasmuch as heat is a performance external to a substance, and the correct term should be "enthalphy." A number of sample calculations were present-

ed and solved in Professor Goff's paper.

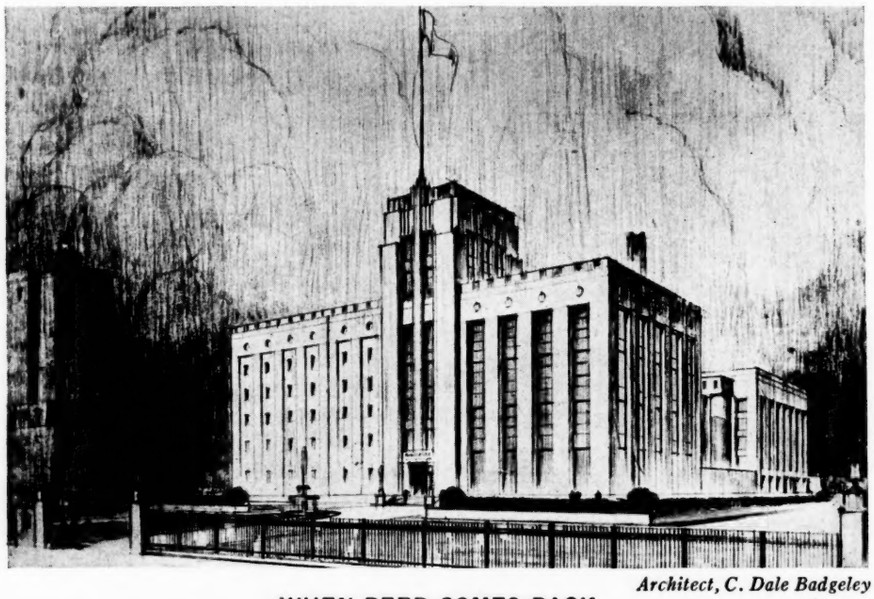
At the afternoon session, December 7, F. G. Hechler, professor of engineering research, and E. R. Queer, instructor of engineering research, Pennsylvania State College, presented a paper "Surface Absorption of Heat from Solar Radiation." The authors presented data showing the relative heat flow for various colors and different materials, such as galvanized iron, asphalt shingles, slate, wood, and glass. It was pointed out that window glass transmits the greater part of solar radiation with very little absorption. However, the glass reflected the long wave radiations from low temperature sources, absorbs them, and converts them into heat which is conducted through the glass. The effects of bright metallic surfaces, wind velocity, heat capacity, and thermal resistance were determined.

A. D. McLay, engineer, Detroit Edison Company, discussed "Air Conditioning and the Central Station" at the concluding session, December 9. Mr. McLay told of the work being done by the National Electric Light Association in investigating the possibilities in air conditioning, and described briefly the work done by the Detroit Edison Company, which has made 42 conditioning installations of all kinds in order to study the subject. The speaker urged the designers of refrigerating machinery to consider the servicing of their machines by the utility, and explained that some apparatus is so designed that various points are inaccessible for servicing.

A. W. Oakley, manager of the technical department, Merchants Refrigerating Company, New York, was elected president of the society for 1933. Other new officers include: Vice-president, Harry Harrison, sales manager of the Brunswick-Kroeschell Division, Carrier Corporation; treasurer, George Lange, vice-president, American Ice Company; directors, O. A. Anderson, chief engineer, Armour & Company, J. B. Churchill, consulting engineer, New York; Crosby Field, president, Flakice Corporation, and L. S. Morse, York Ice Machinery Corporation.

Former Kroeschell Men Organize New Company

An air conditioning contracting and engineering organization has been formed by a number of men formerly connected with the Brunswick-Kroeschell Company, refrigerating machinery manufacturers. The new company is known as the Kroeschell Engineering Company, with headquarters at 2306 N. Knox Ave., Chicago.



Architect, C. Dale Badgeley

WHEN BEER COMES BACK

some of it will be made in air conditioned breweries like that of the New Amsterdam Brewing Company's, contract for which was recently let in New York. Conditioning is necessary in order to obtain the best results in the various stages of beer-making

Arnold H. Goelz is the president and treasurer of the company; Robert A. Kroeschell is vice-president, and Paul H. Kroeschell is secretary. Other members of the company include Otto W. Armspach, Harry M. Coesfeld, Frank Felbinger, William Martens, and Hans A. Stade.

The company is equipped to handle all kinds of air conditioning and refrigeration, including alterations and servicing.

Pierce, Butler and Pierce Reorganizes

Pierce, Butler and Pierce Manufacturing Corp., Syracuse, N. Y., one of the oldest companies in the heating industry, operating five plants and 18 jobbing branches, has reorganized its capital structure, so as to be in a position to compete in the low volume market caused by the decline in building operations.

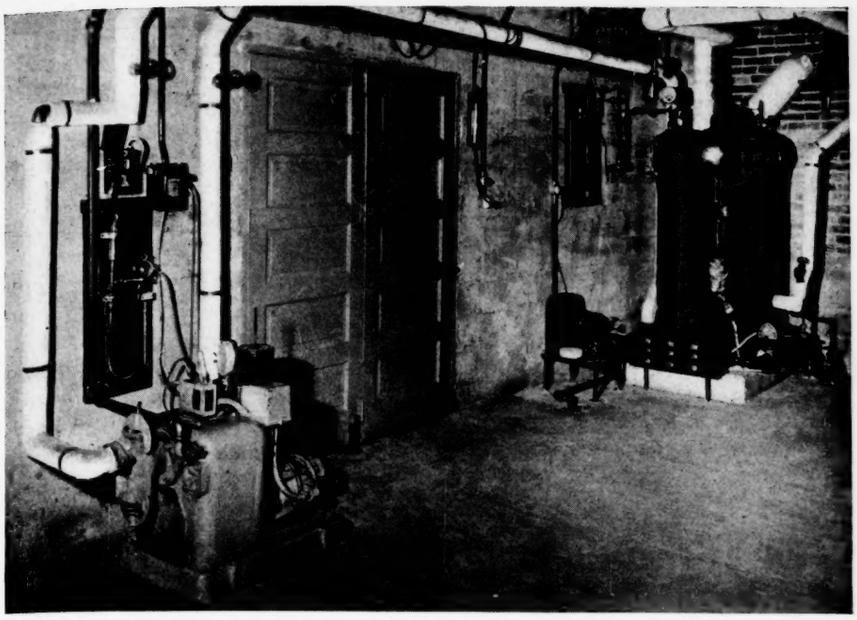
A reorganization committee was appointed early in May, 1932, and a plan of reorganization was adopted. The company filed a voluntary petition in bankruptcy, and its president, Irving N. Beeler, has been appointed receiver. The company will continue to be operated as heretofore, subject to the authority of the United States District Court.

Oil Burners Valued at Twenty Million in 1931

Census figures for 1931, recently released, show that the value of all oil burners manufactured in 1931 was $20.6 million, as compared with $25.7 million in 1929.

Urbana Research Residence Work Feature of N.W.A.H.A. Convention

More than 250 contractors, manufacturers, and manufacturers' representatives gathered for the 20th annual convention of the National Warm Air Heating Association, in Urbana, Ill., December 7-8. At the Wednesday morning session, Prof. A. C. Willard presented a report of the investigations and findings at the research home at Urbana. This report was illustrated by lantern slides, and Professor Willard was



Laboratory in the Wabash, Ind., plant of the Minneapolis-Honeywell Regulator Company, showing heating system used to furnish steam for the various tests

assisted by Prof. A. P. Kratz and S. Konzo.

D. C. Simpson read and discussed the report of Prof. Frank B. Rowley, Minneapolis, in which evidence is presented to indicate that gravity warm-air heating systems will function satisfactorily without the use of fan or blower.

Allen W. Williams, managing director of the association, discussed the problem of the growing expense incurred by manufacturers and contractors in preparing layouts for mechanical installations. It was pointed out that the making of mechanical layouts is a more expensive undertaking than making plans for a gravity system. A canvass of manufacturers indicated that they are unable to absorb the cost of this service, and most of them favored a uniform schedule of charges.

At the Thursday morning session, George W. Burgess, member of the credits and collections committee, urged members to avail themselves of the collection facilities of the association, pointing out the necessity of keeping the secretary posted on delinquent accounts as mutual credit protection for all the association manufacturers and dealers to whom this information is given monthly.

Ralph W. Blanchard addressed the convention with a talk, "Profits in Our Industry," in which he attributed loss of profits to lack of proper cost systems, desire for volume, meeting of competition, unnecessary commercial expense, ambition to sell in large territory, selling mostly cheap goods, and careless credit extension.

William L. McGrath, Williamson Heater Co., Cincinnati, was elected president of the association for the coming year. Other officers are as follows: first vice-president, H. T. Richardson; second vice-president, W. L. Rybolt; treasurer and managing director, Allen W. Williams.

Westinghouse to Make Room Coolers

The air conditioning division of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., organized some months ago, has made public some details regarding the equipment to be made. The line will include room conditioners of 1-ton capacity, to be enclosed in decorative cabinets for visible mounting, and larger units of 2, 4, and 6-ton capacity with attendant refrigerating and control equipment for concealed mounting. This equipment will perform all the functions of air conditioning.

One-ton units will be manufactured in the low-floor type to replace radiators mounted under windows, the high-floor type for other locations, and the ceiling-suspension type. The complete equipment will be installed in the cabinet in these smaller units, making it portable.

News of the Month

Driscoll Addresses Illinois Chapter, A.S.H.V.E.

Forty-eight members and guests of the Illinois Chapter, A.S.H.V.E., at its regular dinner meeting, held at the Sherman Hotel, Chicago, December 12, were addressed by W. H. Driscoll, of the New York Chapter, on the subject, "A Romance of Building." In his talk, Mr. Driscoll presented a story of the reclamation of Park Avenue, in the Grand Central Terminal district in New York, including the erection of the new Waldorf-Astoria Hotel.

A new feature was introduced into the regular program, entitled "Ten Minutes of Something New," in inauguration of which C. H. Blanding spoke briefly on "Some New Developments in Recording Instruments."

Wolff Retires from Wolff & Munier, Inc.

Richard A. Wolff, senior partner of Wolff & Munier, Inc., New York heating and piping contractors, has retired from active participation in the affairs of the corporation. Leon L. Munier has been elected president. Mr. Wolff will continue as a member of the board of directors.

Mr. Wolff is a former president of the New York Chapter, A.S.H.V.E., chairman of the Standards Committee of the H. & P.C.N.A., and one of the founders and first secretary of the New York Building Congress.

Lawrence Pump and Engine Opens St. Louis Office

Lawrence Pump and Engine Co., Lawrence, Mass., has opened an office in the Mart Building, 12th and Spruce Streets, St. Louis, Mo., under the supervision of George Myers.

Kratz, Seeley, Houghten on Annual Meeting Program

A full program of business and entertainment has been scheduled for the members and guests of the A.S.H.V.E. when the society con-

venes at the Hotel Gibson, in Cincinnati, January 23-25, for its 39th annual meeting. Five technical sessions have been arranged, and time has been apportioned on Monday evening for a discussion of the report of the Committee on Revision of the Constitution and By-Laws. The Council and Research Committee of the society have scheduled meetings for Sunday to precede the opening of the technical sessions on the following morning. The program in part follows:

January 23

9:30 a.m.—Greetings, K. A. Wright, president, Cincinnati Chapter.
Study of the Application of Thermocouples to the Measurement of Wall Surface Temperatures, by A. P. Kratz and E. L. Broderick.
Some Observations on Heating Practice, by James Govan.
2:00 p.m.—Air Supply and its Effect on Performance of Oil Burners and Heating Boilers, by L. E. Seeley, J. H. Powers, and E. J. Travanlar.

January 24

9:30 a.m.—Effect of Cold Walls on the Desired Effective Temperature for Comfort, by F. C. Houghten.
Summer Air Conditioning with Heat Energy—a Report on a Series of Field Tests, by E. D. Milener.
Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo.
Summer Cooling Operating Results in a Detroit Residence, by J. H. Walker and G. B. Helmrich.
2:00 p.m.—Corrosion in Air Conditioning Equipment and its Prevention, by R. M. Palmer.
Air Supply, Distribution and Exhaust Systems, by S. R. Lewis.
Cow-Barn Ventilation, by A. J. Offner.
Air Infiltration through Steel Framed Windows, by D. O. Rusk, V. H. Cherry, and L. Boelter.

January 25

9:30 a.m.—Flow of Condensate and Air in Steam Heating Returns, by F. C. Houghten and Carl Gutberlet.
Condensate and Air Return in Steam Heating Systems, by F. C. Houghten and J. L. Blackshaw.

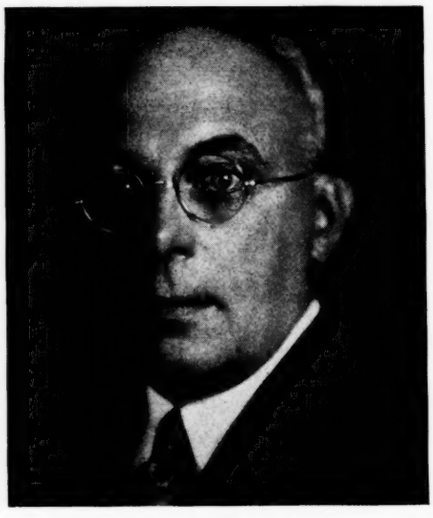
Tuesday evening will be devoted to the annual banquet and dance, and arrangements have been made for entertainment of the women guests at a luncheon and bridge, a theater party, and a tea.

A. S. M. E. Agrees to Cooperate with Manufacturers and A. S. H. V. E. on New Fan Code

Two papers on air flow and the public hearing on the proposed test code for fans were features of the fifty-third annual meeting of the American Society of Mechanical Engineers, held in New York, December 5-9. The public meeting on the fan code resulted in the passing of a motion by the meeting that the A.S.H.V.E. and National Association of Fan Manufacturers will be invited to assist in the preparation of the new code.

Harold F. Hagen, vice-president in charge of research, B. F. Sturtevant Company, presented a paper entitled "Pulsation of Air Flow from Fans and Its Effect on Test Procedure."† Mr. Hagen discussed the error introduced into fan testing by pulsations observed in the fan outlet.

"Influence of Bends in Inlet Ducts on the Performance of Induced Draft Fans" was presented by Prof. L. S. Marks, J. Lomax and R. Ashton. The authors showed that there is a large loss in capacity and efficiency of a fan resulting from the location of elbows and bends close to the inlet boxes. The loss was shown to be a function of the type of bend, of the ratio of depth to width, and of the direction in which the air is turned in the bend. The authors found that by the use of guide vanes in the bend the loss was almost entirely eliminated.



HAROLD F. HAGEN
who presented a paper at the recent annual meeting of the A.S.M.E.

The public hearing was held to discuss the Test Code for Centrifugal Compressors, Exhausters and Fans. The code, prepared by the A.S.M.E. Individual Committee No. 10 on Centrifugal and Turbo-Compressors and Blowers, had previously been discussed by the committee and the society's fluid meter committee. It consisted of two distinct parts, the first relating to centrifugal compressors and exhausters, and the second to fans. Ten members made up the committee, W. H. Carrier and H. F. Hagen being among them.

Although the program stated that the A.S.H.V.E. was cooperating in the program, at least some members of that society were apparently not altogether pleased with the proposed A.S.M.E. code, and the fact that it was considerably different from the existing code of the A.S.H.V.E. and fan manufacturers' association. A strong plea for the two societies and the manufacturers to get together on the proposed code before adopting it was made by Dean F. Paul Anderson, of the University of Kentucky, who said that in his opinion the existing code of the fan manufacturers should be modified if necessary by cooperative agreement, rather than have drawn up an entirely new code in which the manufacturers had not been invited to participate. Mr. Carrier stated that a more elaborate set-up was necessary for the testing of compressors than for ventilating fans, due to the large consumption of horsepower by the former, and suggested that such detailed testing was not required by users of fans for ventilating purposes, which use less horsepower and are in service fewer hours per year. A. C. Davis, assistant superintendent of the Holland Tunnel, speaking as a fan user, also believed this to be the case.

Dr. S. A. Moss, General Electric Company, moved that since the two parts of the code were so dissimilar, and in view of the opposition to the second part, the N.A.F.M. and A.S.H.V.E. should be invited to participate in writing a new code which could be agreed upon by the three groups. The motion was unanimously passed.

A. A. Potter, dean of engineering,

†See abstract, page 46.

Purdue University, was elected president of the society for 1933.

Wells Talks on Building Trades Relations

About 50 members and guests of the Michigan Chapter, A.S.H.V.E., attended a dinner meeting held in the Deland Hotel, Detroit, November 14, at which "Temperature Regulation" was the subject of the evening. The speakers included L. H. Kintz, Johnson Service Company; F. C. Purcell, National Regulator Company; A. C. Grant, Minneapolis-Honeywell Company; E. B. Root, Detroit Safety Furnace Pipe Company; R. D. Randall, Powers Regulator Company, and E. H. Clark, F. I. Raymond Company.

E. P. Wells addressed the regular dinner meeting, December 12, on "Building Trades Relations from Building Owners' Viewpoint."

Titusville Boilers for Government Buildings

Contracts for boiler equipment for government buildings to be erected in Minneapolis, Minn., Newark, N. J., and Rochester, N. Y., have been awarded The Titusville Iron Works Co., Titusville, Pa.

Cold November in East

The temperature averaged 0.8° above normal at Boston; 0.5° below at New York; 2.0° below normal at Pittsburgh; 2.9° below at Chicago, and 4.4° below at St. Louis. Were it not for a cold wave which caused the lowest temperature on record at New York on the 26th and 27th, the month of November would have closed there with a slight excess, as it did at Boston. But the month was cold throughout at all points between the Alleghanies and the Rockies in middle and northern latitudes. A record high barometer for November, 30.82 in., was recorded at New York on the 28th. A feature attending this abnormal pressure was the continuance of north winds for five consecutive days.

McLenegan Appointed to G.E. Air Conditioning Department

D. W. McLenegan has been appointed assistant engineer of the commercial engineering division of the General Electric air conditioning department.

Power Show Acclaimed a Success

Approximately 300 manufacturers of mechanical and power equipment displayed their products at the 10th National Exposition of Power and Mechanical Engineering, held at Grand Central Palace, New York, December 5-10. An attendance of 98,741 was recorded, and visitors and exhibitors' representatives generally expressed the opinion that the exhibition exerted a distinct influence toward the stimulation of business in fields associated with mechanical engineering.

Armco Gives Short Course in Welding

A three-day course in arc welding processes and the theory of design for welded steel construction was recently conducted at the plant of The American Rolling Mill Co., Middletown, Ohio, under the direction of E. W. P. Smith, consulting engineer, The Lincoln Electric Co., Cleveland. Lectures were supplemented by demonstrations in the shop and the instruction covered the following topics: arc welding generators, electrodes, calculation of stresses in welded joints, substitution of welded steel for castings, and the theory of redesign for welded construction.

COMING EVENTS

JANUARY 23-25, 1933. Thirty-Ninth Annual Meeting of the American Society of Heating and Ventilating Engineers. Headquarters at the Hotel Gibson, Cincinnati, Ohio.

JUNE 12-17, 1933. Tenth Annual Convention of the American Oil Burner Association, to be held in Chicago. Headquarters at the Hotel Stevens.

JUNE 19-22, 1933. Fifty-First Annual Convention and Exposition of the National Association of Master Plumbers, to be held in New Orleans, La.

JUNE 27-30, 1933. Twenty-Fouth Annual Convention of the National District Heating Association, to be held in Chicago. Headquarters at the Palmer House.

JULY 25-28, 1933. Annual Convention of the Heating and Piping Contractors National Association, to be held in Chicago.

SEPTEMBER 25-29, 1933. Fifteenth Annual Convention of the American Gas Association, to be held in Chicago.

News of the Month

Rome Radiation Appoints Two Sales Representatives

Rome Radiation Company, Division of Revere Copper and Brass, Inc., Rome, N. Y., has appointed George T. Underwood, Jr., 425 Sharp Building, Lincoln, Neb., as its sales representative in the western portion of Iowa, all of Nebraska, except seven western counties, and the southern half of South Dakota.

H. N. Crawford and H. E. Care, operating as Fuel Saving Engineers, Inc., 1556 North Farwell Ave., Milwaukee, Wis., were appointed the company's representatives in the eastern portion of Wisconsin and the upper peninsula of Michigan.

District Steam Rates Published

The annual edition of "Condensed and Tabulated Steam Heating Rates," published by The RicwiL Co., Union Trust Building, Cleveland, is off the press and ready for distribution. Rates of steam supplied by utility companies in 180 cities are tabulated in detail, the information being of considerable interest to engineers, utilities, architects, etc. Copies of the book will be supplied on request.

Japanese Process Distils Fuel Oil from Coal

A new and inexpensive process, the result of five years of experimenting, by which one ton of heavy fuel oil can be extracted from two tons of high volatile bituminous coal costing 50 cents per ton, has been announced by the South Manchurian Railway. The chief source of the coal is the great Fushun open-cut coal deposits in Manchuria, estimated to contain 950 million tons.

Fisher Governor Opens New York Office

Fisher Governor Co., Marshalltown, Iowa, announces the opening of a direct factory sales and engineering office in New York, with offices at 30 Church Street. O. M. Galiher, A. W. Bailey, and J. J. Belger will be connected with this office.

News of the Month

Shackelford New Officer on Power Show Committee

H. N. Shackelford, Johns-Manville Corp., New York, has been elected secretary of the Exhibitors Committee, Industrial and Power Shows, Inc., at a recent meeting of the board of directors of that body. Among those chosen to serve on the board of directors for 1933 are: H. S. Wheller, L. J. Wing Mfg. Co., New York; H. M. Hammond, Bailey Meter Co., Cleveland, and J. F. McNamara, International Nickel Co., New York.

School Ventilation Is Topic at Philadelphia Meeting

A. J. Nesbitt, of the John J. Nesbitt Co., Philadelphia, presented a paper entitled "A Logical Basis for Determining the Volume of Air in Class Room Ventilation" at the regular meeting of the Philadelphia Chapter, A.S.H.V.E., held December 8, at the Engineers Club. Harry Black also reported on the progress of his committee which is cooperating with the Philadelphia Technical Service Committee.

Sanford Speaks on Office Building Cooling

Thirty-five members and guests of the Western Michigan Chapter, A.S.H.V.E. heard S. S. Sanford, Detroit Edison Company, present his paper "Field Studies of Office Building Cooling," at the group's regular meeting, held November 14, at the Rowe Hotel, Grand Rapids. Stereopticon slides showing instrument set-ups and characteristic curves plotted from data obtained from extensive observations made on the cooling equipment in a large Detroit office building illustrated the talk.

Cameraman's Antarctic Adventures Entertain New York A.S.H.V.E.

About 60 members and guests of the New York Chapter, A.S.H.V.E., gathered for the regular monthly dinner meeting at the Building Trades Club, December 19, to hear Willard Van-der Veer, Paramount ace cameraman, who presented the picture, "With Byrd at the South Pole," and described his adventures as photographer with the Antarctic expedition. The chapter welcomed Samuel R. Lewis, past president of the society, to the meeting.

Oil Burner Show Space Half Sold

Approximately one-half of the available space offered for the 10th annual show and convention of the American Oil Burner Association, scheduled for the Hotel Stevens, Chicago, June 12-16, has been sold, according to an announcement of the association. Held in conjunction with the Chicago World's Fair, it is predicted that the show will be a complete sell-out, enjoying an attendance never previously attained.

Nesbitt Appoints Philadelphia Distributor

John J. Nesbitt, Inc., Holmesburg, Philadelphia, has announced the appointment of the Sheffler-Gross Co., Drexel Building, Philadelphia, as its exclusive distributor in that territory.

Correspondence

Reader Comments on Service of Heating Plants

EDITOR, HEATING AND VENTILATING:

The writer was considerably interested in the editorial on page 48 of the November, 1932, issue of HEATING AND VENTILATING entitled "Oil Burner Service." This brings to mind the condition which we have here at the present time in which a coal dealer handling the sale of automatic stokers, sold one of our customers stoker equipment and placed it under a down-draft cast-iron boiler. Now it has been called to our attention from other sources that there is considerable difference of opinion regarding temperatures throughout the building, and it so happens they have one tenant in the building who requires 72° 24 hr. a day inasmuch as it is a telegraph office. The argument goes on between the building owner, stoker man and tenant due to the mere fact that the party or company who sold the stoker does not have the necessary facilities for recording room temperature in the particular locations in which the argument started.

It only brings it down to this one point—if the coal dealer is going to sell stoker equipment in connection with the fuel that he sells, he should have all the necessary equipment to combat any arguments which might arise due to poor operation or differences in temperatures. It must be borne in mind in this particular instance that this customer has purchased steam from the public utility company since the fall of 1927 and does have a first-class heating system of the differential type, and no doubt the particular tenant in the building who is complaining about service is thinking back over the last five winters of continuous service from our company.

While we do have the instruments available for checking this temperature, neither the stoker salesman nor the building owner cares to humble himself to ask for the loan of them. The writer certainly feels we all have something in common regarding the sale of heating service whether it be from a stoker-fired plant, central station steam, oil burner, or gas. Certainly all of us should work together along this particular line in giving the best possible heating service regardless of the type of equipment.

I think your editorial is very well summed up in your last paragraph which starts "If any equipment man is not prepared to do these things, he may as well quit now." On the particular installation just mentioned there is a question whether the stoker is of ample capacity for the heating system, as from indications there is a vacuum on the boiler at practically all times, which proves rather conclusively that a stoker is not large enough, which again comes to the fact that if the stoker man had had a combination recording pressure and subatmospheric gauge installed at the time the equipment was installed, he would then have had plenty of chance to prove his case whether or not the stoker was ample to take care of the heating load.

P. A. HYDE
Supt. of Steam Distribution,
Akron Division,
Ohio Edison Company.

Water Vapor in Flue Products

EDITOR, HEATING AND VENTILATING:

Referring to Question 63, "Your Everyday Problems," in your December, 1932, issue, one of the most widely accepted errors is the assumption that the water vapor of combustion, being steam at atmospheric pressure, will condense at 212°. Such is not the case. It would only be true if the fuel were pure hydrogen combined with oxygen, instead of air, in which case the vapor tension at sea level would exactly equal the air pressure of 29.92 in. Hg., with the well-known dew point of 212°.

But the nitrogen of the air acts as a diluent, as does the portion of oxygen that combines with carbon to form CO_2 or CO, the sulphur, etc., and following Dalton's Law of Partial Pressures of gases, the water vapor exerts only that portion of the total pressure corresponding to its relative volume, hence the mixture is not saturated at 212°, and will not begin to condense until it is cooled to its dew point—well below this.

About 25 years ago, Prevost Murphy published in *Engineering News* a set of psychrometric tables with a clear explanation of dew points, their corresponding temperatures and vapor tensions for saturated mixtures of air and water-vapor. Yet, among many graduates of major engineering schools who have come under my instruction, not one knew their use. This is not surprising, since most works on combustion ignore the subject or pass over it lightly. Too, I heard the head of a great school which graduates many combustion engineers annually, explain the condensing action of one of my direct-fired heat exchanger designs with the statement that "condensation started when the flue gases were cooled to 212°."

He was doubly wrong. Condensation started at a point within the exchanger where the gases were well above 212°, despite the fact that their dew point was 110° to 130°, because they were rubbing against surface that was being subjected, on the other side, to a flow of 80° to 90° air. The gases that touched this "cold" surface gave up their moisture as readily as it collects on a cold water pitcher in a hot room. This explains the pouring of water from the fire tubes of an oil or gas-fired H.R.T. boiler when quick-started from a cold stand, with light draft. Many operators think the tube ends leak, but close by heat expansion later. If the fuel is high in sulphur, the "sweat" is dilute sulphuric acid, and the boiler life will not be long, if many cold starts are made.

These conditions have been ignored in the design of many oil and gas-fired units. There are "pockets" at cold locations where the gases can stratify and move but slowly. These points will be found to be damp, even when the general stack gas temperature is wastefully high. A few years duty, and the unit will leak—corroded through. The usual evasion of this is to burn more than normal fuel rating and admit plenty of excess air to further dilute and reduce the gases' dew point.

The owner pays for these wasteful practices and broadcasts the bad news that oil and gas are "too high." An occasional flue simply will not carry the additional gases, and the heater is presently junked.

Many exterior wall flues require so much air dilution to prevent condensation that 25% of the house heat demand in zero weather is lost at this one point. Some one would do the cause of fuel conservation a great service if he would devise a

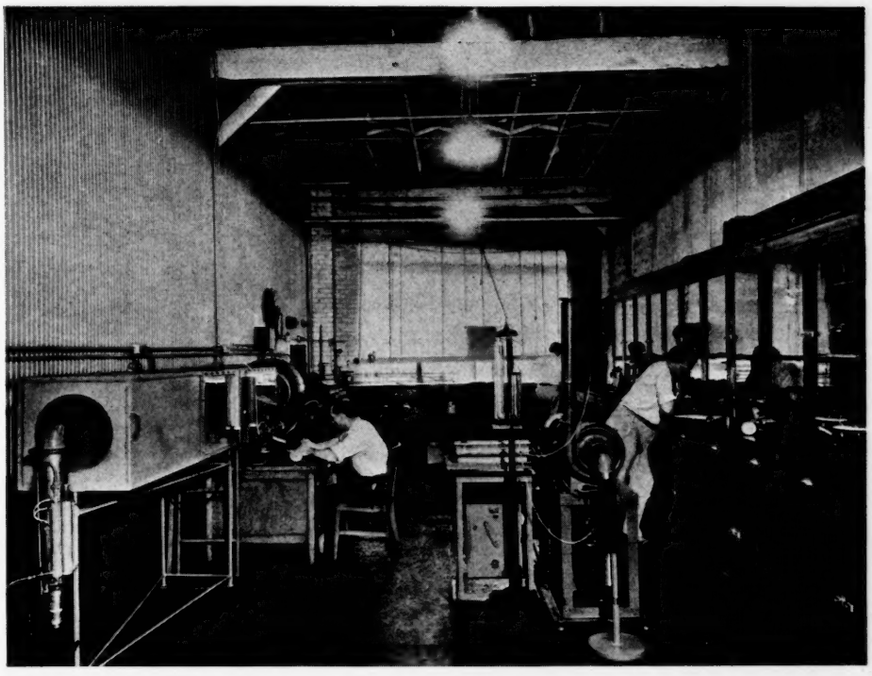
Correspondence

way to teach architects and builders how to build flues for oil and gas. The essential requirement is a moisture-tight liner. They should be carried up with three sides within the house, but if built external to the walls, should be insulated and provided with a dry-well or drained base.

To determine the flue gas dew point, make the regular volumetric computation of products of combustion from the fuel analysis your Orsat and barometer readings. For example, suppose you are burning a high hydrogen gas and find that your water vapor is 20% of your total gas volume. Then your vapor tension is not 29.92 in. Hg. at 212°, but 20% of 29.92, or 5.98, and referring to your table, you will find that your dew point is 141° for this vapor pressure. If you have burned 1000 cu. ft. of this gas, it is interesting to note that you have combined 30 lb. of gas with about 500 lb. of air, burned it, and by cooling to about 60°, recovered 60 lb. of water. You can't ignore a lot of water that would take many thousand cubic feet of air at room temperature to absorb, or more than 60,000 B.t.u. to evaporate.

EVERETT S. BUCK

Ft. Wayne, Ind.



Physical research laboratory of the American Air Filter Co., Inc., Louisville, Ky.

New Equipment

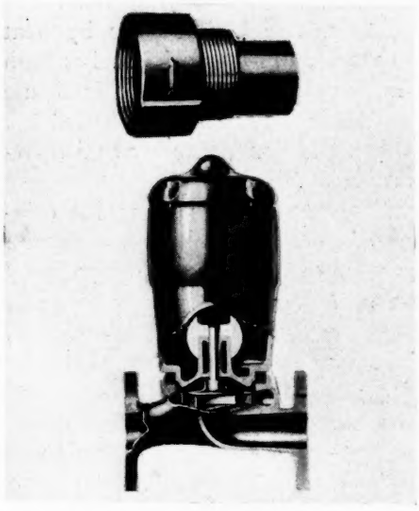
One-Pipe Hot Water Heating System

A mechanically-circulated one-pipe method of hot water heating, called the Force-Flo system, has recently been devised by The Stevens-Root Co., 51 East Grand Ave., Chicago, manufacturer of the shunt and pump incorporated in the system.

One small main replaces the larger supply and return mains ordinarily used. Radiator and riser connections, both supply and return, are made to the main by tees into which Force-Flo shunts are screwed, as shown. This shunt consists essentially of a bushing, located eccentrically in the pipe, which directs some of the water, flowing in the upper side of the main, up into the riser or radiator connection. On the return connection, the bushing is so located that the cold water will be introduced into the lower part of the main. The bushing constricts the section of the main beyond the riser or radiator supply connection sufficiently to prevent all of the water from flowing past the connection.

Circulation is produced by a centrifugal pump, mounted with motor and direct-connected rotor shaft vertically to the boiler return. Stainless steel shafting is used in this apparatus, and this passes into the pump housing through a rotary seal, eliminating the stuffing box with its packing.

System will operate with the usual expansion tank, or with any of the closed or tank-in-basement arrangements. Automatic control may be effected by means of a room thermostat connected to cut the pump in and out as needed. On automatically-fired installations the pump should be wired so as to operate when the burner or stoker is working. Two sizes of pump are manufactured for residential and small building use, up to 1500 sq. ft. of equivalent direct radiation. The manufacturer states that the system can be satisfactorily applied to larger jobs.



Shunt (above) and circulator (below)

Control Switch for Varied Heating and Cooling Applications

Detroit Lubricator Co., Detroit, is manufacturing the No. 250 control switch in various models for the control of temperature, pressure, or vacuum. They are furnished single pole, single throw, either to close the circuit at low or to close it at high, or double throw, and are suitable for regulation of oil burners, draft blowers, automatic stokers, or for control of flow of steam, water, gas, air, etc.

A bellows element, actuated by pressure direct or by a volatile liquid for temperature operation, actuates the switch mechanism to make or break the circuit. A permanent magnet at the contacts provides a quick opening or closing, and prevents excessive arcing. All models are enclosed in a black bakelite case, with removable cover. Both the operating range and the differential are adjustable, and all types can be provided with hand reset.

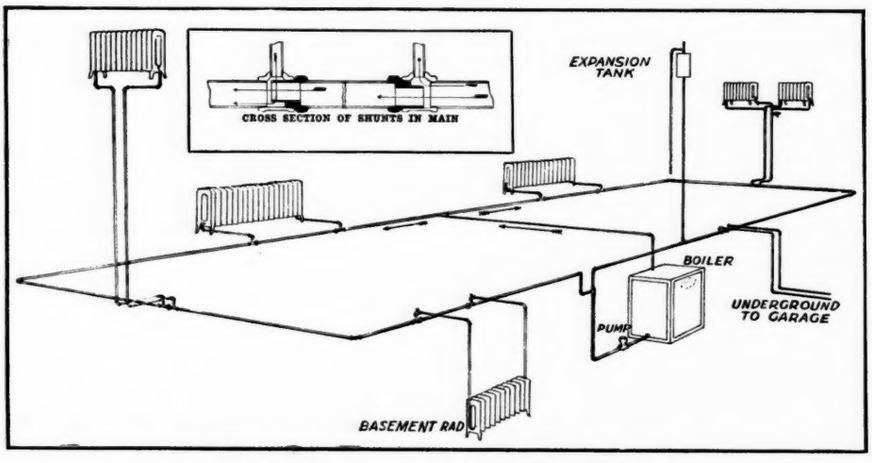
Switches will carry 110 volts, or 220 volts, direct or alternating current. Through the use of an automatic starting switch, units of any size may be controlled.

Instrument Measures Smoke Density

An instrument for measuring by electro-optical means the density of smoke emitted from stacks has been developed by The Brown Instrument Co., Philadelphia. It may be used with any of the standard models of Brown indicators or recorders, either of the potentiometer or millivoltmeter type.

A sampling tube containing a source of light and a photo-electric cell is inserted into the stack or flue. This tube consists of two concentric cylinders, the outer one being 6 in. in diameter and about 4 ft. long, with orifices arranged in each in such a manner that flue gas will pass through them. The cylinders are welded together at the orifices so that the annular space between the cylinders forms an air duct leading to the air outside the stack.

A small electric lamp operating on 6 volts, and designed for use in temperatures as high as 600° is placed at the focal point of a parabolic reflector at the inner end of the sampling tube. The reflector is chromium-plated, and both reflector and lamp are gasketed to prevent their coming in contact with flue gas or air circulating around the assembly.



Force-Flo hot water heating system

No auxiliary source of energy is required for the light sensitive photo-cell located at the outer end of the tube. When the smoke in the flue gas varies in density, the amount of light transmitted to the photo-cell is varied accordingly and the resulting current variations from the photo-cell are transmitted to the indicating or recording device.

Thermostat in Bonnet Regulates Furnace Output

Thomas Long Controls Co., Inc., 624 Leland Ave., South Bend, Ind., is marketing the Long automatic heat regulator for warm-air furnaces. It controls thermostatically the draft and check damper in accordance with the bonnet temperature to maintain a steady heating rate as set on a dial in the living quarters.

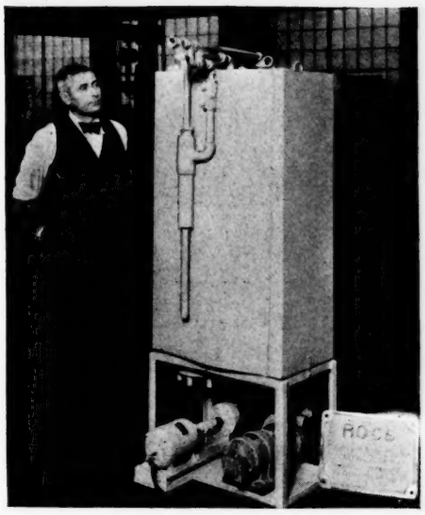
A metal tube having a high coefficient of expansion is anchored to the furnace housing, and encloses a metal rod of low coefficient of expansion. Linked to these is the operating lever to which the draft and damper operating chains are attached. Increased heat in the bonnet moves the lever downward, closing the ashpit door and opening the check damper, and the reverse takes place as the bonnet temperature is reduced. When the fire door is opened both the draft and check damper are closed.

Centrifugal Pump is Self-Priming

Worthington Pump and Machinery Corp., Harrison, N. J., has recently announced a self-contained automatically-primed centrifugal pumping unit. This consists of an electrically-driven ball-bearing centrifugal pump mounted with its motor on a fabricated steel bedplate, together with a Monobloc priming unit of the wet vacuum type, controlled by an electric pressure switch. The evacuator is connected to the high point of the suction volute through substantial tubing, and is sealed with clear water held in a reservoir built into the main bedplate. The centrifugal pump is primed when air is removed from it by the evacuator.

Evacuator motor is connected across the main pump motor line at a point between the starting switch and the motor, so that in starting the pump, the evacuator motor starts also. The pressure switch is placed in the evacuator motor circuit and its pressure connection is piped to the discharge nozzle of the main pump. Whenever the discharge pressure of the main pump is below a predetermined point, the pressure switch is in the closed position. When the discharge pressure comes up to normal the switch opens and remains open as long as the pressure is maintained. If the pump loses its prime, the discharge pressure drops and the evacuator pump is placed in operation.

Self-priming pumps are available in the Worthington types R, U, L, and F, in sizes up to No. 6.



COMPACT STEAM-EJECTOR REFRIGERATOR UNIT

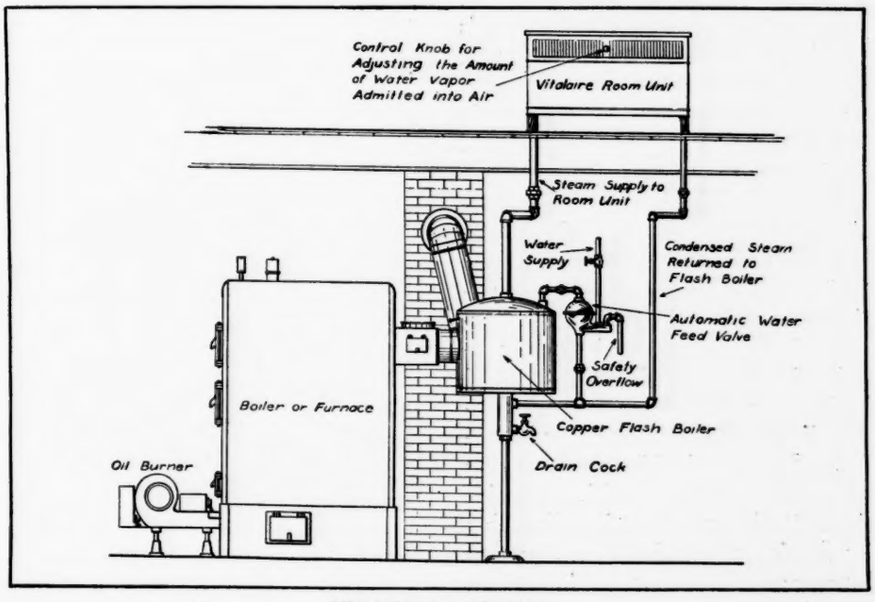
This unit, manufactured by the Ross Heater & Mfg. Co., Inc., Buffalo, N. Y., operates on a steam pressure of 12 lb. gauge, and has a refrigerating capacity of 2.5 tons at 50°. It is suitable for cooling drinking water, for cooling water for air conditioning purposes, or for any process requiring water at a temperature between 35° and 60°. Units operating on steam pressures from atmospheric up are available in sizes from 2 tons to 20 tons. Principle of operation is as described in HEATING AND VENTILATING, September, 1932, page 67.

Humidifier Operates on Waste Heat from Stack

Waste heat carried from the furnace in flue gases is absorbed and applied to warming and humidifying by the Vitalaire flash boiler and radiator unit manufactured by The Cornelius Co., 4711 Upton Ave., S., Minneapolis, Minn.

Hot gases from the stack are passed through the flash boiler before entering the chimney, and steam is generated from the heat extracted. The unit is constructed of copper, and contains a heat transfer element consisting of 80 ft. of seamless copper tubing. An automatic feeder connected into the water supply line contains a constant level.

A copper radiator of fin and tube construction located in the living quarters above is connected by supply and return pipes to the steam space of the flash boiler. Air enters

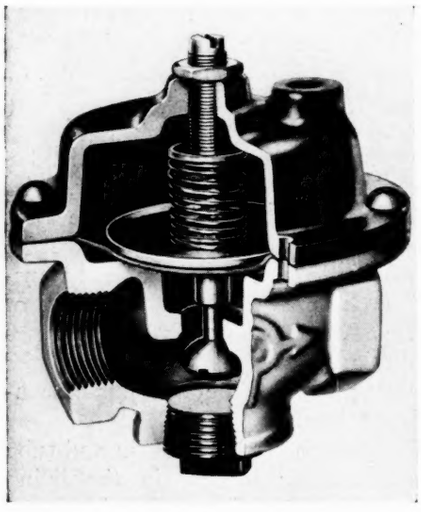

Control Knob for Adjusting the Amount of Water Vapor Admitted into Air
Vitalaire Room Unit
Steam Supply to Room Unit
Water Supply
Condensed Steam Returned to Flash Boiler
Automatic Water Feed Valve
Safety Overflow
Boiler or Furnace
Copper Flash Boiler
Oil Burner
Drain Cock

Vitalaire installation

the bottom of the radiator cabinet and discharges through an opening at the top front by convection. A portion of the steam is released into this air stream to supply humidification. The amount of humidity added to the rooms is controlled by manual adjustment of a damper at the discharge opening, by means of which the volume of air flow is regulated.

Valve Maintains Constant Gas Pressure

Merco Nordstrom Valve Co., 2431 Peralta St., Oakland, Calif., is manufacturing the Calemco gas pressure regulator, a device for maintaining



Calemco gas pressure regulator

a constant pressure at the burner with varying service line pressure and varying volume demand. It is applicable to gas radiators, unit heaters, radiant heaters, gas boilers or furnaces, storage or automatic water heaters, and similar gas-fired equipment.

Valve seats and openings are designed to accommodate the maximum volume flow of the pipe line, and yet maintain accurate regulation at small volumes. Valve material is wear-resisting bronze, capable of being ground to form a good fit in the valve seat. A large flexible diaphragm of selected and carefully treated kidskin operates the valve to provide sensitive regulation. Outlet pressure is adjustable by turning up or down on a spring by means of a screw, held in place by a lock nut.

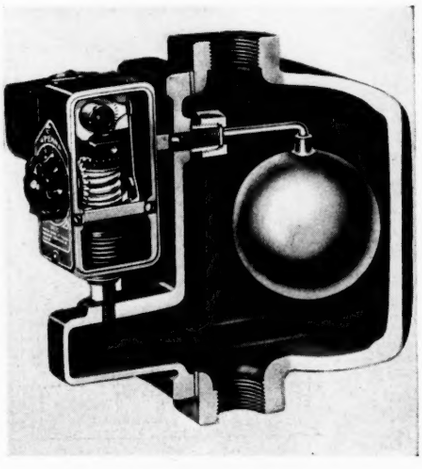
Regulators are tapped for outlet in both the side and bottom for convenience in piping, the unused opening being fitted with a plug. It is made in ½ in. and ¾ in. sizes, and unless otherwise specified will be adjusted to deliver an outlet pressure of 4 in., with an inlet pressure of 7 in.

Protection Against Low Water and High Pressure

Air Conditioning Equipment Corp., Milwaukee, Wis., is manufacturing the Boilertrol combination low water cut-out and pressure control for automatically-fired steam heating boilers. The device is designed to protect the boiler by breaking the circuit to the oil burner, stoker, or other firing device in the event of a dangerous rise in pressure or the water level falling below the safe limit.

Separate circuits are provided for each control feature as a precaution against failure. When the water level falls below the point at which it supports the ball float, the circuit is opened. A sylphon bellows actuates the pressure control switch. Switches consist of an armature carrying a large silver contact moving toward and away from the permanent magnet poles, between which is a stationary silver contact. The circuit, therefore, is made and broken in the field of a magnet, preventing arcing and providing for snap movement on both closing and opening operations. The assembly is housed in a black moulded bakelite case, fitted with a tight cover to keep out dirt.

Units are made in two styles, designated Type J, Models JFP and

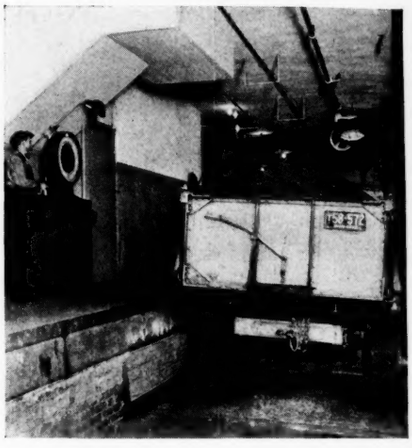


Open view of Boilertrol

JFPA. Cut-out pressure is adjustable for both range and differential on Model JFP, while Model JFPA has a non-adjustable differential. Pressure ranges are from 0 lb. to 14 lb., and from 2 lb. to 14 lb., respectively. Pipe tappings are for 1-in. standard threads.

Scale Prints Record of Coal Deliveries

Scales for installation on the consumer's premises, enabling factories, hotels, institutions, and other large coal users to accurately check coal deliveries, have been announced by Toledo Scale Co., Toledo, Ohio. The loaded truck runs onto a platform where the gross weight is recorded by the scale. After the coal has been deposited in the storage space the empty truck is weighed and a printed record is made by the scale.



Printweigh scale installed in heating plant of department store

This record is made in triplicate for convenience, one copy of which is given to the coal company, one to the accounting department, and the third is retained by the receiving department. The device is known as the Auto Truck Printweigh.

Base Insulates both Fan and Driving Motor

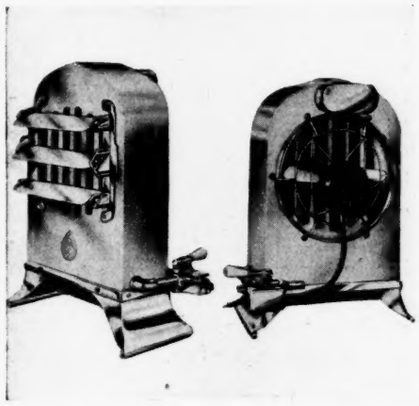
Buffalo Forge Co., Buffalo, N. Y., has announced the Buffalo floating fan base, for insulating a fan and its driving motor from building foundations.

Base consists of structural steel channels of standard dimension, and extends completely under the fan and motor. Flexible rubber insulators, so designed that there is no

metal contact between the fan and the bolts holding the base, provide the damping effect. These insulators are made with the rubber under shearing stress rather than in compression, which is said to prolong its useful life. Bases are supplied in sizes to fit standard fans.

Gas-Fired Unit Heater Is Portable

Surface Combustion Corp.,Toledo, Ohio, has announced the Heatmaster portable gas-fired unit heater which it recommends as effective for heating small stores, offices, and similar applications. It is also useful in heating residential rooms which are not properly cared for by the central heating plant, and for supplying heat to one or more rooms during the fall and spring when it is impractical to operate the heating plant.



Front and rear views of gas-fired unit heater

Unit is of polished aluminum with chromium trim. A twin-blade motor-driven fan circulates air over the heating surfaces and delivers it into the room at a temperature of 110°. Adjustable louvers direct the air flow as desired. The heater is 17 in. high, and occupies a floor space of 12½ in. by 8 in. The fan delivers 350 c.f.m. of warm air, and the unit is said to be equivalent to approximately 62 sq. ft. of steam radiation.

Built-up Belting Developed for Air Conditioning Drives

Condor V-belting from which inelastic stretch has been eliminated has been developed for air conditioning drive by The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., 120 Broadway, New York.

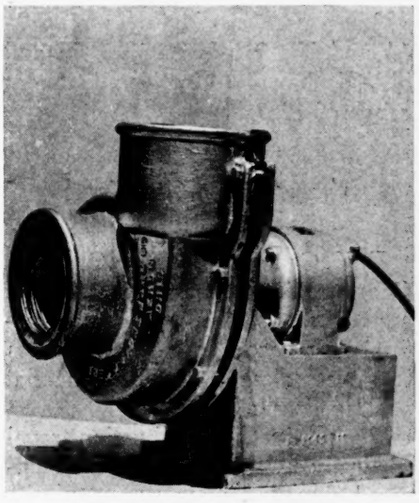
For light-duty, high-speed application the limber Condor Whipcord construction is used. This type consists of one layer of continuously wound cords imbedded between two layers of tie-gum. The balance of the belt is filled out with the correct proportions of extensible and compressible rubber with a closely-woven rubberized duck jacket to complete the structure.

With heavier-duty drives the Plycord type of belting is used. This is built up of continuously wound strips of cord fabric with one layer of tie-gum between each ply. When the proper thickness is reached it is cut to the contour of the belt, and the balance of the construction is similar to that of the Whipcord drive. Among the advantages of Condor belting as noted by the manufacturer are: strength, uniform flexibility, maximum traction, slow side wear, and no inelastic stretch.

Exhaust Fan Lined with Corrosion-Proof Stoneware

For handling air laden with corrosive substances, The United States Stoneware Co., 50 Church St., New York, has developed a line of exhaust fans lined with chen ical stoneware. They are suitable for ventilating laboratory hoods, pickling rooms, and various process plants.

All parts that come in contact with the air or gases are made of incorrodible chemical stoneware, protected by an outer armor of cast iron. Impellers are of the open-front, non-clogging type, and are assembled to the motor shaft by means of a four-jaw clamp which insures correct alignment and rigidity, and still permits convenient removal. Provision is made for semi-flexible inlet and outlet connections, and the discharge may be rotated through 360° and locked at any angle.

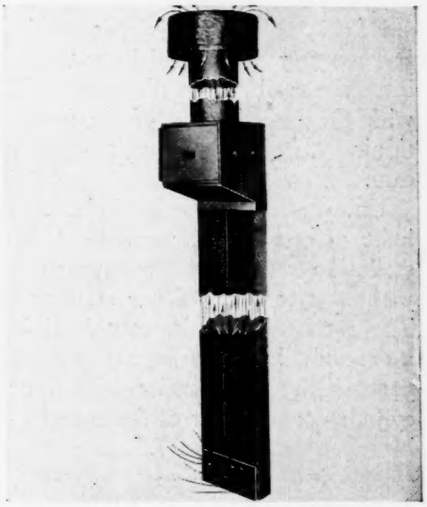


Corrosion-proof exhaust fan

Exhausters are available either with direct motor drive, or with provision for belt drive. Standard units are made for B & S pipe connections at both the suction and discharge, but flanged connections can be had on special order. Sizes are 3 in., 4 in., and 6 in.

Forct-Air Unit Ventilator

Forct-Air Co., Rockford, Ill., has announced a small unit ventilator for home, office, and industrial use.



Model A Forct-Air unit ventilator

Ventilators are constructed of heavy-gauge metal finished in battleship gray. Circulation is produced by a shrouded high-speed propeller-type fan driven by an alternating-current motor. Units are available in one size only in each of two models. Model A is for installation in a flat to round offset hookup with rectangular intake 4½ in. by 12 in. and discharge 8 in. round. Model B is for straight line hookup with 10 in. round intake and discharge.

Ratchet Burring Reamer is Easy to Operate

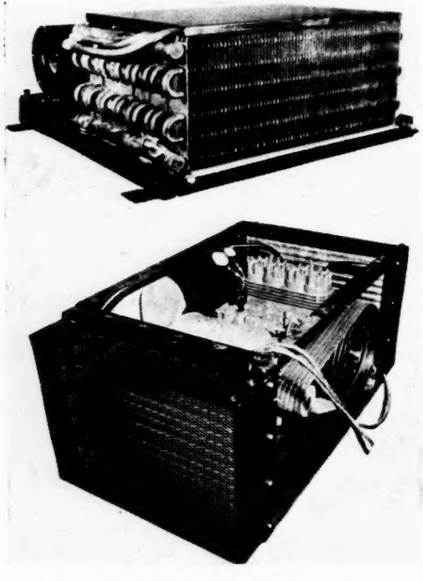
Greenfield Tap and Die Corp., Greenfield, Mass., has introduced

the No. 246-R ratchet burring reamer for easy and rapid removal of burrs from the inside of pipe. This tool has spiral flutes which give it shearing action and feed it into the burrs, greatly increasing the ease of cutting and decreasing the necessary pressure on the stock. The ratchet head is enclosed to keep dirt and burrs from entering the moving parts, and the polished tubular handle is light and unbreakable. It can be used with pipe from ¼ in. to 2 in., and is also said to be effective in enlarging holes in sheet metal, countersinking, and various other purposes.

Frigidaire Announces Railroad Air Conditioning Equipment

Frigidaire Corp., Dayton, Ohio, has recently announced its entrance into the railway equipment field with the introduction of air conditioning apparatus for passenger cars.

Units are compactly built and light of weight for convenient installation on present rolling stock without alteration of car structure. The mechanical unit, contained in a rectangular housing suspended beneath the car, consists of a four cylinder compressor of 5-ton capacity when driven by a 7.5-hp. motor, and 7-ton capacity when driven by a 10-hp. motor. The refrigerant, freon, is carried from the compressor to coils in the bulkheads through small pipe lines installed without change in the car structure.



(Above) One of two coil units for a dining car installation, and (below) mechanical refrigerating unit for suspension beneath car

Provision is made for introduction of new air to be mixed with recirculated air, and this is cooled and dehumidified by contact with the surfaces of the direct refrigerating coils before it is discharged into the passenger space.

Temperature Regulator Controls Refrigerator Brine Flow

Sarco Co., Inc., 183 Madison Ave., New York, is marketing a temperature regulator for refrigerating systems.

A thermostatic tube communicates through a flexible connecting tube with an oil-filled operating cylinder in which a spring-balanced plunger moves to regulate the opening of a valve to control the brine flow. Increased temperature raises the pressure of the oil in the thermostatic tube, and this forces the plunger to open the valve against the spring, allowing a greater volume of brine to circulate in the cooling coils. The device is protected against damage in the event of overheating by a relief spring.

Regulators are made in 10 sizes, ranging from ½ in. to 4 in., in two types each, for cold room control and for drinking water control. They are calibrated at the factory for the temperature to be maintained, and an adjusting screw permits a raising or lowering of this temperature by 15° in either direction in Types KR-14 and TR-21. Types KR-25 and TR-25 have a total adjustment range of 100°.

Thermidaire Gas-Fired Unit Heater

E. K. Campbell Heating Co., 2441 Charlotte St., Kansas City, Mo., has announced the Thermidaire gas-fired unit heater in a series of sizes to meet almost any commercial heating demand.

The products of combustion travel vertically upward through the staggered finned copper tubes, of the heat exchanger surface, over which the room air is circulated in a horizontal direction by the fan. A multiple tube gas burner is used, each tube having its own orifice mixer. A gas pressure governor is provided. A low voltage thermostat controls the fan motor and the magnetic gas valve simultaneously, and in case of power failure, the gas supply is automatically shut down. The apparatus is enclosed in a 16-gauge steel casing, supported by an angle iron frame, and finished with two coats of enamel with nickel trim.

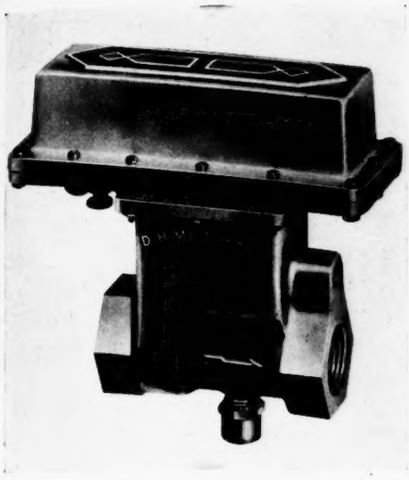
Thermidaire gas-fired unit heater

Units are made in six sizes, ranging in capacity from 200 sq. ft. to 1665 sq. ft. of equivalent direct steam radiation. Fan discharges range from 600 c.f.m. to 5000 c.f.m.

Temperature Control for Gas-Fired Appliances

McCorkle Nugent Co., 354 Hobart St., Oakland, Calif., has announced a temperature control for gas-fired heating appliances, which it recommends as practical for use with floor furnaces, room circulators, and space heaters, as well as for larger central gas furnaces.

This equipment consists of a small electric transformer connected into the lighting circuit, a room thermostat sensitive to a fraction of a degree, and a simplified gas valve actuated by a bi-metallic thermostatic element heated by an electric resistance element through which current is passed when contact is made in the room thermostat. This has a toggle and spring construction that results in snap-action opening and closing of the valve which takes place approxi-



McCorkle electric gas valve

mately 90 sec. after contact is made or broken in the thermostat.

Valves are made in two sizes, with ½-in. connections for 100 cu. ft. per hr., and ¾-in. connections for 175 cu. ft. per hr. at ½-in. pressure drop. The valve body of both sizes is tapped for a ⅛-in. pilot connection.

Motor-Operated Three-Way Valves Announced by Barber-Colman

Motor-operated three-way valves have been announced by Barber-Colman Co., Rockford, Ill. They are for use on spray-type humidifiers, for mixing valves on fluid tanks, or in any application where it may be required wholly or partially to discharge one or both of two sources into a common outlet or to divide the output from a single source all into one or partially into both of two outlets.

A small shaded pole induction motor turns a cam through a train of reduction gears and moves the valve plunger up or down to place the double-faced disc against either of the two seats or to adjust it properly between them as required. Valves may be controlled from a manual or automatic switch or from a suitable thermostat. The valve operates on a 25-volt, 60-cycle alternating current. It is available in either positive or reversing type in sizes between ½ in. and 2 in.

Window Filter and Ventilator Unit

H. S. Kaiser Co., 936 West Chicago Ave., Chicago, is marketing the Kaiseraire filter ventilator for home, office, and institutional use.

Appliance is installed in the window and blocked off to prevent air entering room except through filter. A multispeed fan draws outside air in through an opening in the rear of the cabinet, passes it through the filter, and propels it into the room through the discharge openings. Adjustable grilles permit the air flow to be deflected in any direction. The filter and damper serve to dampen noise originating outside the window. By a simple adjustment the device may be made to recirculate air in any proportion to outside air taken in. Filter elements are easily replaced when they have become loaded with dirt.

Two sizes are made, the smaller passing from 50 c.f.m. to 200 c.f.m., and the larger from 100 c.f.m. to 400 c.f.m.

Temperature Regulator Sensitive to $\frac{1}{10}°$

Hiergesell Brothers, 2518 North Broad St., Philadelphia, Pa., has announced the Red Top thermoregulator, a precision temperature control device said by the manufacturer to be sensitive to 1/10° change throughout its entire range of from 0° to 300°. The instrument is completely enclosed in a glass shell 10½ in. in length, capped by bakelite to which the terminals are attached.

Whitney Announces Brake

Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill., has announced an improved metal brake for forming stock up to 16 gauge. The work is held against a stationary platen, and two coil springs balance the weight of the lower mechanism, relieving the operator of any lifting effort. It is stated by the manufacturer that the tool can be converted to a box or pan brake in a short time.

McCord Makes Finned Pipe

Finned pipe for the heating elements in concealed radiators is being marketed by McCord Radiator & Mfg. Co., Detroit, Mich.

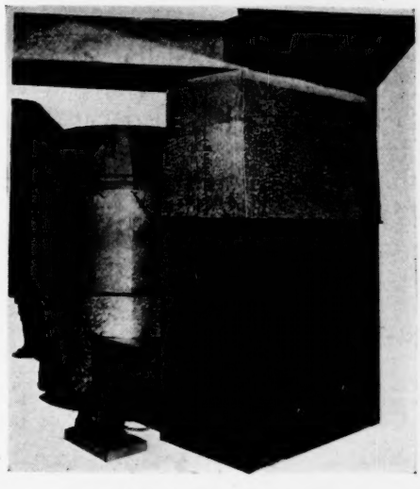
Fins are applied by winding a ribbon of copper or steel around the pipe and either galvanizing or tinning the surface. The outer portion is stretched and the base of the fin is crimped by this method, resulting in a pressure joint between the fin and the pipe. The fin is slightly thicker at the base than at the outer edge, and this in addition to the crimping results in a greater area of metal-to-metal contact at the joint.

Finned pipe may be had in standard lengths up to 20 ft. It is available in ¾ in. size with 1 in. fin, 1 in. size with 1¼ in. fin, and 1¼ in. size with 1½ in. fin. Copper fins are wound with ¼ in., ⅛ in., ½ in., and ¾ in. pitch or spacing, and steel fins are spaced at ½ in. and ¾ in. The manufacturer claims that fins spaced at ¼ in. increase the heating capacity to seven times that of the same length of plain pipe.

Flash Pan Humidifier in Conditioning Unit

Liberty Foundry Co., 7600 Vulcan St., St. Louis, Mo., has added the Mellow Aire conditioner to its line of warm-air heating equipment.

Circulation is produced by motor-driven blowers, drawing the return air into the casing, passing it through four glass-wool filters, and discharging it into the furnace where it is heated and humidified. Humidifying system consists of a wood block hygroscopic controller, mounted directly in the conditioner cabinet, and a flash pan which is installed on the furnace radiator. The condition of the return air passing the controller regulates the amount of water that is fed almost continu-



Mellow Aire conditioner

ously into the flash pan where it immediately becomes steam. Bearings consist of hollow cast balls wool-packed and bronze-bushed, which are clamped between two flanges. This assembly is attached to the casing with rubber insulation.

Pipe Hanger Has Ball and Socket Joint

A line of adjustable ball swivel pipe hangers has been added to the line of Square Gee pipe fittings and hangers manufactured by The Grabler Mfg. Co., Cleveland. These hangers are available in the solid type, No. 351, or in the hinged type, No. 352.

The ball and socket joint provides flexibility. Vertical adjustment is by a threaded swivel which may be turned up or down on the suspension rod, a locknut permanently retaining the desired position.

A forked end on the arm of the hinged type hanger rests on a ledge on the socket, removing the load from the locking device. The hinged arm is held in this position by a U-shaped steel strap which is locked into a notch in the arm by a slight hammer blow after the pipe is in place. The offset position of the hinge permits the pipe to be put into position from the side, and provides a convenient hook to support the pipe until the fitter has closed the arm.

Grabler adjustable ball swivel hanger

Workrite Electric Humidifier

Humidifier Has Floating Evaporator

Workrite Specialty Co., 3129 North 28th St., Milwaukee, Wis., has announced the Workrite electric humidifier for home or office use.

Evaporation of water is accomplished by the use of an electric immersion heater located in a floating chamber whereby only a small quantity of water is boiled at one time. The bulk of the water is not changed in temperature until admitted to the heating chamber. As the vapor rises it is circulated throughout the house by means of a quiet induction motor-driven fan.

It has the appearance of a vase, and has a black crystallized finish, with chromium-plated base and grille. The unit holds approximately 9 qt. of water, and evaporates nearly 1 qt. per hr. An automatic safety device opens the circuit when the water is exhausted. The heating element is rated at 660 watts.

Thermostatic-Time Control Schedules Heating for Week

A thermostatic-time control combination, consisting of the Mercoid Dual Sensatherm thermostat and a synchronous electric time switch with built-in low voltage relay, has been introduced by The Mercoid Corp., 4201 Belmont Ave., Chicago.

Dual thermostat combines two distinct units with independent adjustments. This instrument operates on a temperature differential of ½° above or below the setting which can be increased to 3° by a simple adjustment. A single day-time switch is used for general application where it is desired to lower the temperature at the same time each day. This control can be furnished, however, with a seven-day dial with individual clamps for setting each daily program for any desired time operation, making it possible to schedule the heating program for a week in advance.

Dual sensatherm can be furnished to either open or close the circuits on a rising temperature. For air conditioning equipment it can be furnished as a summer-winter thermostat. When connected with the proper relay equipment it will operate as a two-speed unit heater control.

Humidifier Evaporates Moisture from Revolving Discs

A portable humidifier and air washer for home and office use has been announced by The Emerson Electric Mfg. Co., 2018 Washington Ave., St. Louis, Mo.

Air is drawn in through one of two grilles in the top of the cabinet by a motor-driven fan, circulated over moisture-bearing discs, and discharged back into the room through the other grille opening. Water is contained in a rust-proof reservoir within the cabinet, and the partially submerged discs are slowly revolved by the fan motor so as to be continually picking up water on their surfaces. Rotation of the discs and

Emerson humidifier

the fan is so slow that operation is practically noiseless. The humidifier is also said to be an effective washer, as a large part of the dirt from the air is deposited on the wet discs, to be carried away when the water is drained.

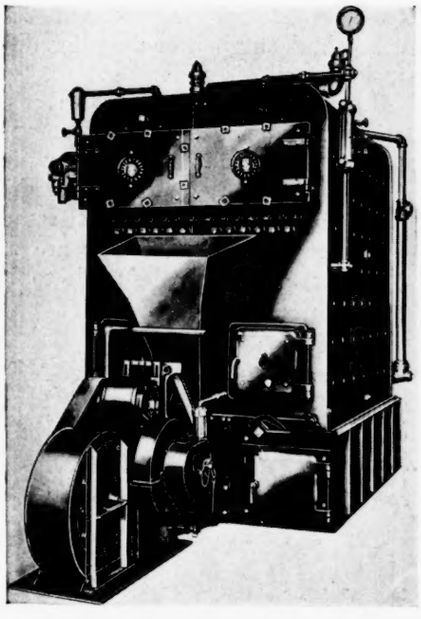
Cabinet is 24½ in. high, 15 in. deep, and 28 in. long, and is wood finished in walnut with aluminum grillework. It can evaporate 6 gal. per day and is of sufficient capacity for an average home of eight to ten rooms.

Stoker-Boiler Unit Burns Low-Priced Fuels

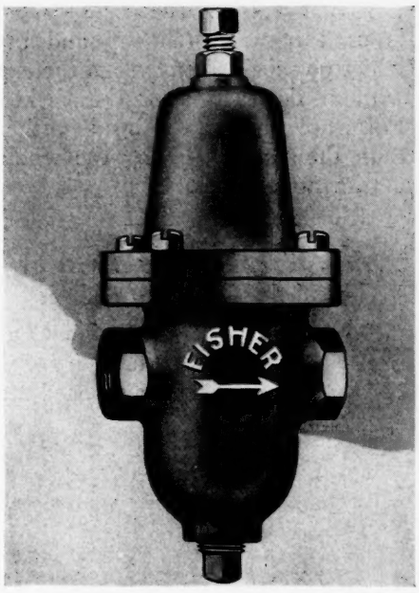
Spencer Heater Co., Williamsport, Pa., has announced a coordinated stoker-boiler unit designed to burn low-priced grades of bituminous coals.

Boiler is of the combination water-tube and fire-tube type, and is built in two sections for accessibility. Combustion chamber dimensions, particularly its height, are such as to promote efficient and smokeless combustion of inexpensive high volatile fuels. The combustion chamber is entirely surrounded by water walls, and has a built-in bridge wall connected to both the side and rear water walls. No brick or tile is required in the setting of the unit.

Stoker is of the Jones side-dump type, and is equipped with Riflex mechanical drive. Units range in capacity from 6,000 sq. ft. to 40,000 sq. ft. of direct steam radiation.



Spencer stoker-boiler unit



Fisher pressure reducing valve and regulator

Adjustable Pressure Reducing Valve and Regulator

Fisher Governor Co., Marshalltown, Iowa, is manufacturing the Class BB pressure reducing and regulating valve for use with steam, water, air, and other fluids. The manufacturer recommends it as adapted for use in the water line to the spray nozzles in air conditioning apparatus.

Regulators are furnished with cast bronze body construction for high or low pressure service. When specified for water and non-corrosive fluids, diaphragms of pliable fabric base are used. For steam and corrosive fluids, regulators are supplied with laminated metallic diaphragms. Adjustment for the desired reduced pressure is made by turning the screw in the top of the body in or out, or to regulate the compression on the adjusting spring.

Valves are suitable for a maximum initial pressure of 250 lb. and a minimum reduced pressure of 2 lb. They are supplied with screwed connections only, and these come for ⅛ in., ¼ in., and ⅜ in. pipe sizes.

Instrument Selects Correct Drive

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced the Texdrive calculator, an instrument which selects the correct drive to meet the conditions of any installation. One setting of the dial will indicate the diameters of driver and driven wheels, number of Texropes, size of drives, a choice of center distances, horsepower of the drive, catalog number, and price. No information is available as to the cost of the instrument.

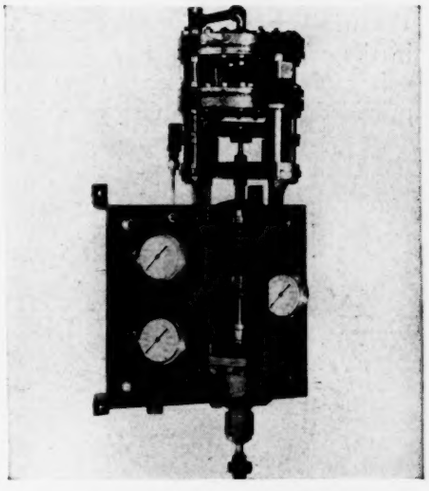
Warm-Air Furnace and Stoker Combination

A coordinated warm-air heater and stoker, combining electric firing, electric temperature regulation, and electric limit control in a compact unit, is offered in the MonsoN automatic coal furnace, manufactured by The Riester & Thesmacher Co., Cleveland.

Coal is charged on the grate in the firepot of the furnace by an adjustable-stroke moving plunger, and the fire is agitated at each plunger stroke by a plowing device. Air is introduced both above and below the fuel bed by the blower, which also provides booster air to the furnace casing to accelerate circulation. A tray slid into the ashpit, easily withdrawn when full, facilitates ash removal. The furnace is made of heat-resisting steel, of welded fabrication. Control is effected by a standard room thermostat, operating in conjunction with a low limit control in the stack.

Control Maintains Pressure Differential

For accurately maintaining a desired pressure differential in a steam



Swartwout Type CPDM Master Control

system, the type CPDM master control, a product of The Swartwout Co., 18511 Euclid Ave., Cleveland, has recently been placed on the market.

An auxiliary motive force, which may be air, water, steam, or oil under pressure, is passed through the body of the master control and is applied to the operation of a single valve, a group of valves, motor rheostats, cutout switches, or other type of control equipment for maintaining the required differential between the two pressures in the main fluid, applied respectively to the upper and lower diaphragms of the device. Gauges are mounted on a panel board to indicate the true controlled pressures and the intermediate operating pressure.

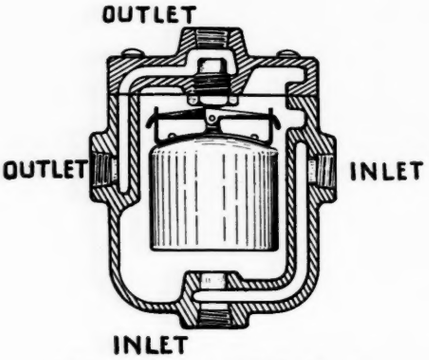
Filter for Warm-Air Systems

A filter for warm-air heating systems has been announced by the Filtaire Corp., 111 West Bruce St., Milwaukee, Wis. The Filtaire will be supplied with standard collars to fit the various pipe sizes. Filter element is mounted on a slide to facilitate removal and replacement for cleaning purposes.

Radiator Trap Has Double Inlet and Outlet

Spade-Thayer Co., 307 Bird Ave., Vandercook Lake, Jackson, Mich., has included a radiator trap in its complete line of steam traps recently placed on the market. It is of the inverted bucket type, employing the twin-leverage principle embodied in the company's traps.

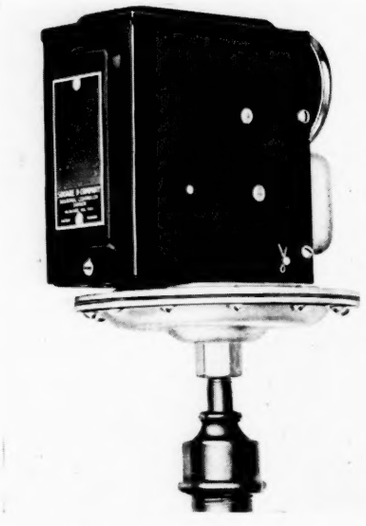
Two inlets and two outlets are provided, making piping combinations convenient. A copper gasket is used between the cap and the body, permitting removal of the cap without destruction of the gasket. Ports are cast on the inside rather than the outside, giving the whole a trim appearance.



Spade-Thayer radiator trap

Alarm Sounds When Water Level Exceeds Safe Limit

Square D Co., Industrial Controller Div., 710 South Third St., Milwaukee, Wis., has announced the


Square D high-water alarm

Class 9036 H1 high-water alarm which sounds a warning when the liquid in a sump or open tank reaches an excessively high level.

Alarm consists of a single pole pressure switch, a transformer, and signal bell wired in one unit and mounted on a length of 1-in. pipe. A rising column of liquid in the pipe exerts air pressure on the diaphragm of the switch, closing a contact and ringing the bell. The warning signal will continue until the high liquid level has been reduced to a safe limit.

Automatic Damper Control Provides Temperature Regulation

Hart & Cooley Mfg. Co., 61 West Kinzie St., Chicago, is marketing the No. 1003 heat control system for day and night temperature regulation, comprising a dual room thermostat, an electric time switch operated by a Telechron clock, and a damper motor, together with all necessary accessories.

Damper motor is of the induction type, of rustproof construction, and having self-lubricating bearings. The circuit is so designed that all contacts are made within the motor, preventing any arcing in the thermostat. The electric clock operates the switch that changes the control from the day to the night switch.

Speed Reducer Has Integral Motor Drive

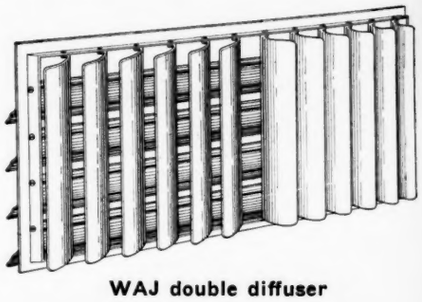
Merkle-Korff Gear Co., 213 North Morgan St., Chicago, is manufacturing a small speed reducer with integral motor drive. The unit can be supplied for practically any speed required, from the 3000 r.p.m. speed of the motor downward, and may be had for either clockwise or counter-clockwise rotation. Both horizontal and right-angle drives are available with the output shaft in any position. Gears run in grease sealed in the case.

A shaded pole induction motor or a synchronous motor may be had for alternating current service, or a universal motor is supplied for direct current use. The overall dimensions of the unit are: height, 3⅛ in.; width 3⅛ in.; depth 2⅜ in.

Diffuser Has Horizontal and Vertical Vanes

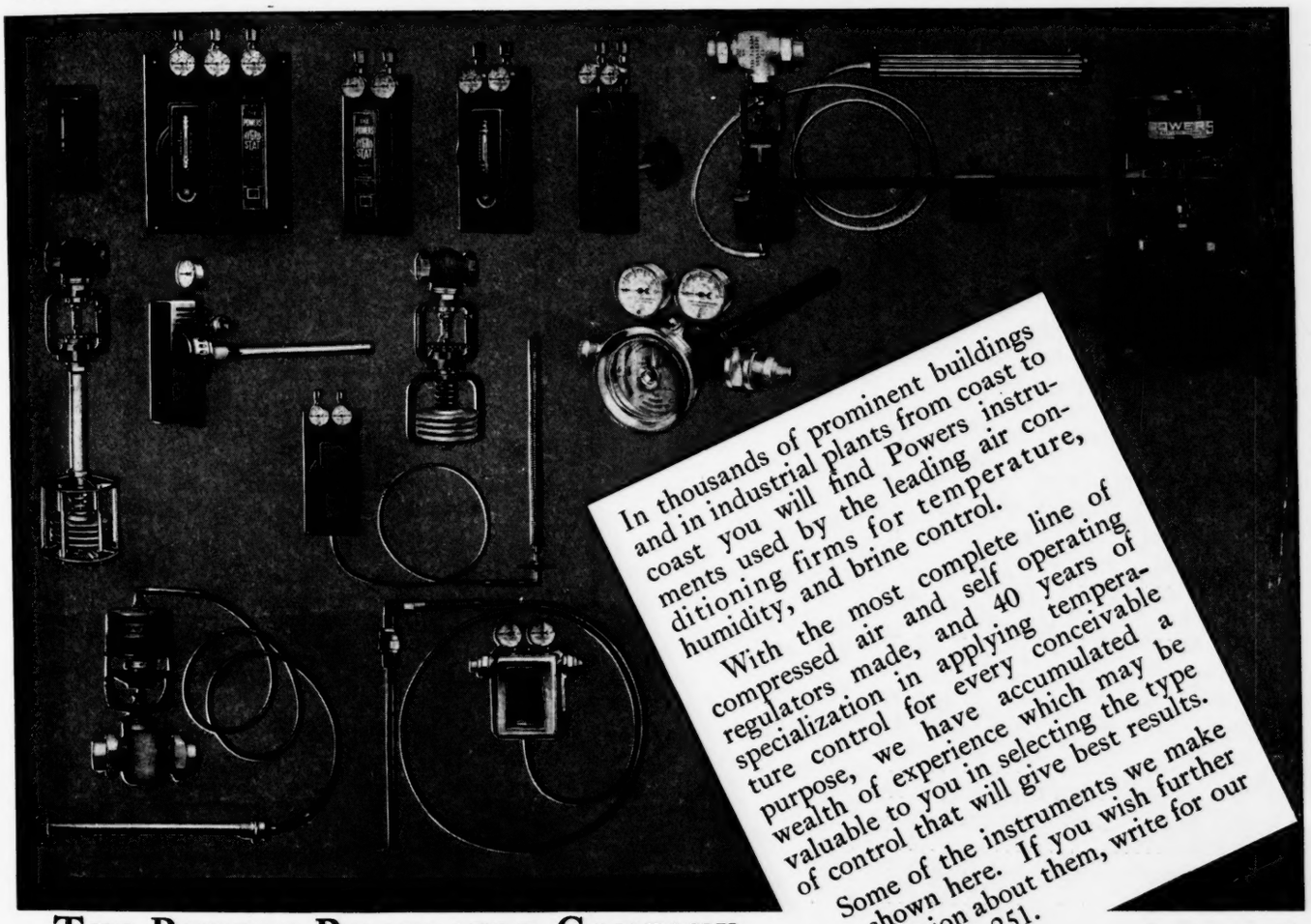
Adjustable diffusers for ventilating or air conditioning system air outlets are being marketed by The WAJ Mfg. Co., 2119 Washington St., Kansas City, Mo. The appliance has two sets of louvers or diffusing vanes, one vertical and the other horizontal, providing for diffusion in all directions.

Louvers are No. 16 gauge cold rolled steel, and are spaced on approximately 3 in. centers. They are adjustable to any position, and the front horizontal louvers can be faced in either direction. Frames are of ⅛ in. stock and can be made to fit any size of outlet.


WAJ double diffuser

If IT'S AIR CONDITIONING CONTROL *SEE* POWERS

INSTRUMENTS for CONTROLLING AIR CONDITIONING EQUIPMENT



In thousands of prominent buildings and in industrial plants from coast to coast you will find Powers instruments used by the leading air conditioning firms for temperature, humidity, and brine control.

With the most complete line of compressed air and self operating regulators made, and 40 years of specialization in applying temperature control for every conceivable purpose, we have accumulated a wealth of experience which may be valuable to you in selecting the type of control that will give best results.

Some of the instruments we make are shown here. If you wish further information about them, write for our Bulletin No. 251.

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Birmingham	Chattanooga	Davenport, Ia.	Houston	Milwaukee	Pittsburgh	Salt Lake City	Montreal
Boston	Cincinnati	Denver	Indianapolis	Minneapolis	Portland, Ore.	San Francisco	Vancouver
Buffalo	Cleveland	Detroit	Kansas City	Nashville	Reading, Pa.	Seattle	Winnipeg

Degree Days and Unit Fuel Consumption in Typical Cities

November, 1932

UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.t.u. per hr., and for radiation calculated on a basis other than zero outside to 70° inside.

Coal is assumed as having a heat content of 12,000 B.t.u. per lb., gas, 1000 B.t.u. per cu. ft., and oil, 140,000 B.t.u. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content of the fuel actually being used in the installation being calculated.

For radiation installed for any other outside temperature than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption which is given for steam radiation by 5/8.

	New York	Seattle	San Francisco	Chicago	Denver	Boston	St. Louis	Pittsburgh	Minneapolis
Degree days	637	481	147	832	632	667	720	714	1028
Total degree days since September 1	929	968	352	1309	1237	1013	997	1085	1745
Lb. of coal per sq. ft. of radiation for November	5.096	3.848	1.176	6.656	5.056	5.336	5.760	5.712	8.224
Gal. of oil per sq. ft. of radiation for November	0.437	0.330	0.101	0.571	0.433	0.457	0.494	0.490	0.705
Cu. ft. of gas per sq. ft. of radiation for November	61.15	46.18	14.11	79.87	60.67	64.03	69.12	68.54	98.69

	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree days	30	576	577	270	517	737	714	833
Total degree days since September 1	44	807	795	302	664	1118	1056	1292
Lb. of coal per sq. ft. of radiation for November	0.240	4.608	4.616	2.160	4.136	5.896	5.712	6.664
Gal. of oil per sq. ft. of radiation for November	0.021	0.395	0.396	0.185	0.355	0.505	0.490	0.571
Cu. ft. of gas per sq. ft. of radiation for November	2.88	55.30	55.39	25.92	49.63	70.75	68.54	79.97

	Buffalo	Birmingham	Indianapolis	Memphis	Des Moines	Kansas City	Louisville	Galveston
Degree days	827	466	818	526	958	750	662	228
Total degree days since September 1	1304	586	1205	676	1508	1098	937	244
Lb. of coal per sq. ft. of radiation for November	6.616	3.728	6.544	4.208	7.664	6.000	5.296	1.824
Gal. of oil per sq. ft. of radiation for November	0.567	0.320	0.561	0.361	0.657	0.514	0.454	0.156
Cu. ft. of gas per sq. ft. of radiation for November	79.39	44.74	78.53	50.50	91.97	72.00	63.55	21.89

Fuel consumption figures must be corrected for local conditions as explained above.

AIR

INSULATION PROTECTS THE PACKING OF THE ADSCO DUPLEX SLEEVE EXPANSION JOINT

In the expansion joint of conventional design, the heat is transmitted through a steel sleeve direct to the packing.

In the ADSCO Duplex, Air Insulation reduces the transmission of heat to packing from 25% to 45%.

● Instead of the conventional single sleeve construction, the ADSCO Duplex Sleeve Expansion Joint is designed with double sleeve, separated by an air chamber.

Because of this air chamber, transmission of heat from the inner to the outer sleeve is greatly modified and packing life is proportionally prolonged.

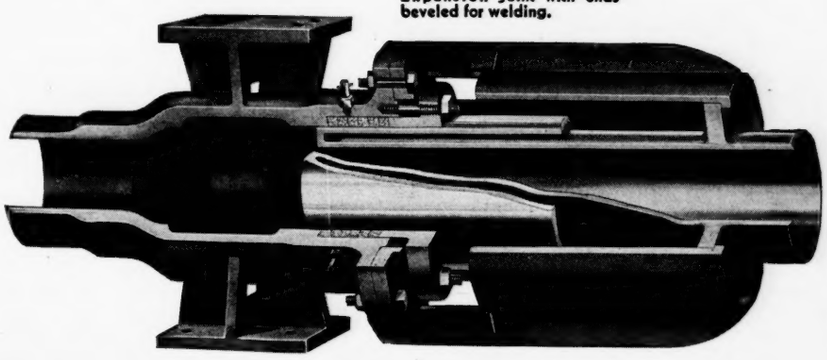
According to tests made at Carnegie Institute this reduction in heat transmission to packing runs as high as 45%.

That is why the ADSCO Duplex stays tight under the severe conditions of high temperature steam service. Many Duplex Sleeve Joints have been in constant service from 6 to 8 years without requiring repacking!

When your installation requirements call for a heavy duty expansion joint that is qualified to give out-of-the-ordinary satisfaction in service, it will pay you to investigate the ADSCO Duplex.

Write for complete information and prices.

The ADSCO Duplex Sleeve Expansion Joint with ends beveled for welding.



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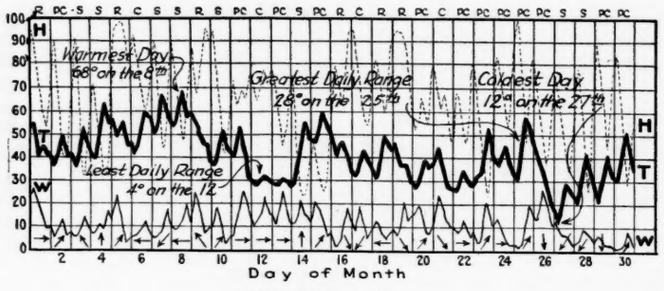
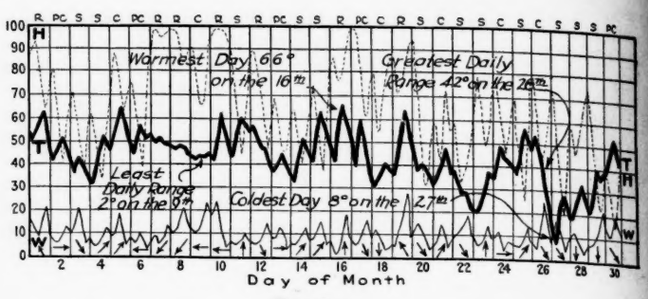
The Weather

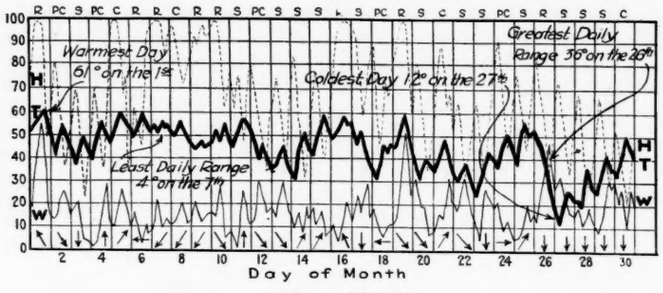
November, 1932


Warmest Day 68° on the 8th
Greatest Daily Range 28° on the 25th
Coldest Day 12° on the 27th
Least Daily Range 4° on the 12
Day of Month

Pittsburgh

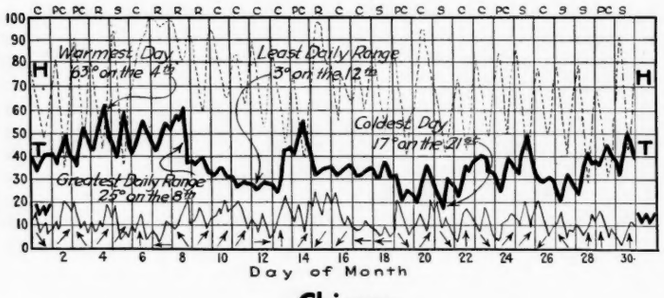

Warmest Day 66° on the 16th
Greatest Daily Range 42° on the 26th
Least Daily Range 2° on the 9th
Coldest Day 8° on the 27th
Day of Month

Boston

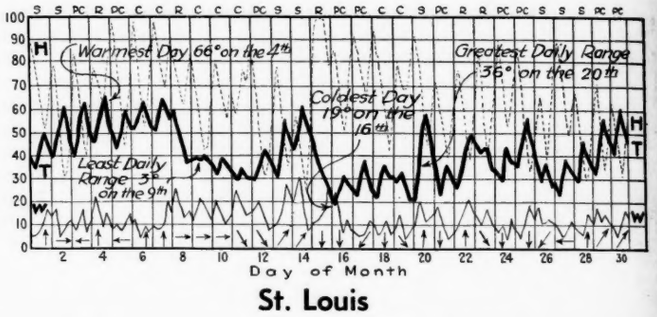

Warmest Day 61° on the 1st
Greatest Daily Range 36° on the 20th
Coldest Day 12° on the 27th
Least Daily Range 4° on the 7th
Day of Month

New York

(Hourly observation of the Relative Humidity Plotted on this Chart)


Warmest Day 63° on the 4th
Least Daily Range 3° on the 12th
Coldest Day 17° on the 21st
Greatest Daily Range 25° on the 8th
Day of Month

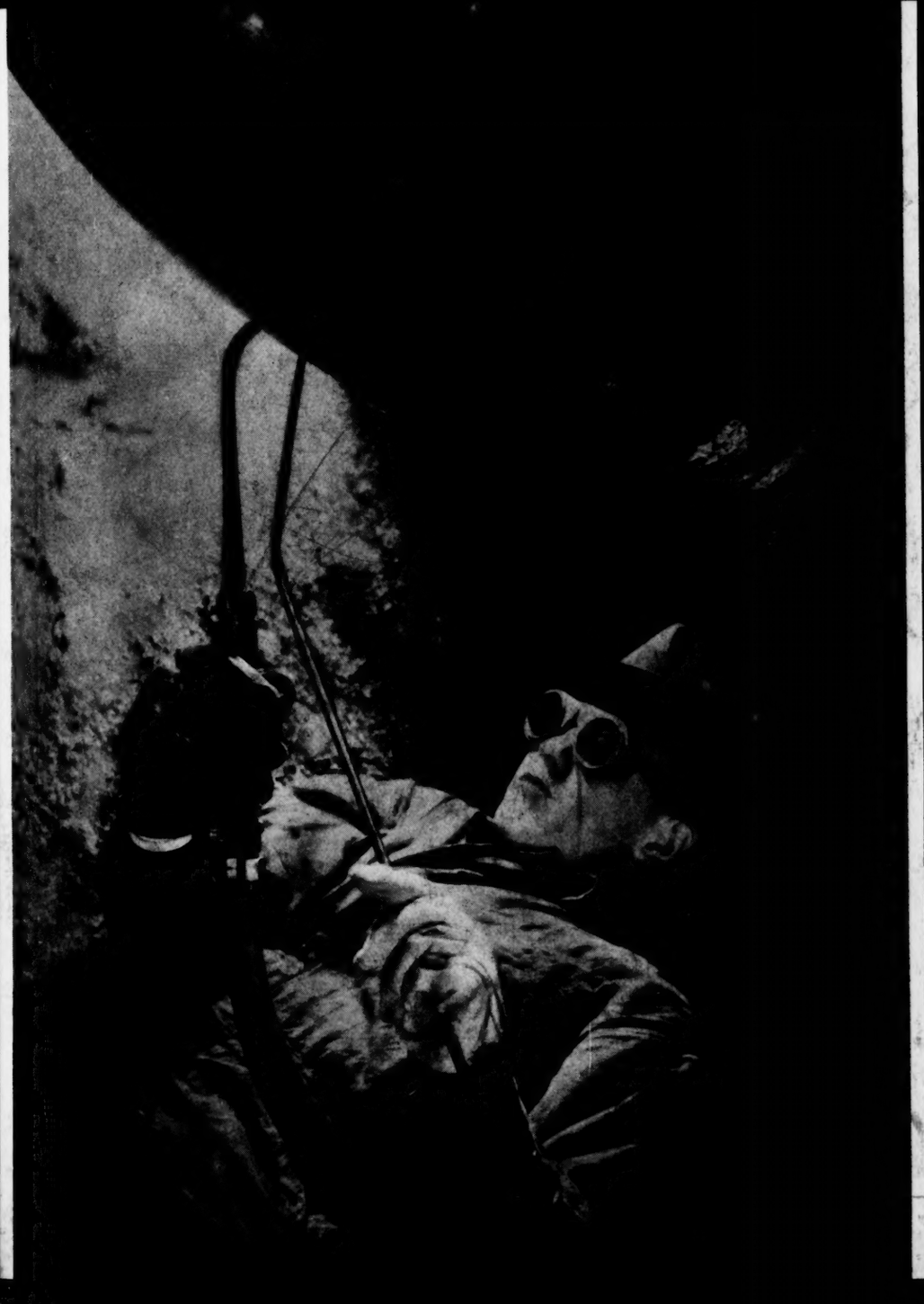
Chicago


Warmest Day 66° on the 4th
Greatest Daily Range 36° on the 20th
Coldest Day 19° on the 16th
Least Daily Range 3° on the 9th
Day of Month

St. Louis

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	61	66	68	63	66
Date of highest temperature	1	16	8	4	4
Lowest temperature, deg. F.	12	8	12	17	19
Date of lowest temperature	27	27	27	21	16
Greatest daily range, deg. F.	36	42	28	25	36
Date of greatest daily range	26	26	25	8	20
Least daily range, deg. F.	4	2	4	3	3
Date of least daily range	7	9	12	12	9
Mean temperature for month, deg. F.	43.7	42.8	41.2	37.2	41.0
Normal mean temperature for month, deg. F.	44.2	42.0	43.2	40.1	45.4
Total precipitation, this month, inches	5.87	5.24	3.22	2.24	2.08
Total snowfall, this month, inches	None	Trace	Trace	0.6	5.3
Normal precipitation, this month, inches	2.96	3.33	2.29	2.37	2.83
Total wind movement, this month, miles	11,349	7,032	6,924	8,194	8,497
Average hourly wind velocity, miles	15.8	9.8	9.6	11.4	11.8
Prevailing direction of wind	N.	N.W.	W.	S.W.	S.
Number of clear days	11	9	8	7	12
Number of partly cloudy days	8	11	11	7	9
Number of cloudy days	11	10	11	16	9
Number of days with precipitation	10	9	8	5	5
Number of days with snowfall	None	None	Trace	1	2
Snow on ground, at end of month	None	None	None	None	None

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 a. m., 12 m., and 8 p. m. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.



FEBRUARY
1933